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Volume 9 • Issue 52 • 2003

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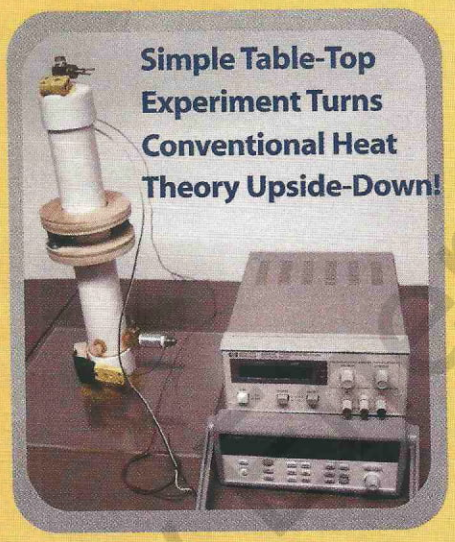

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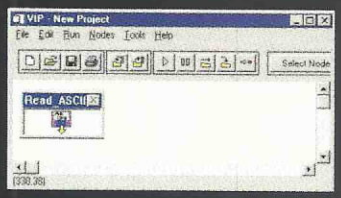

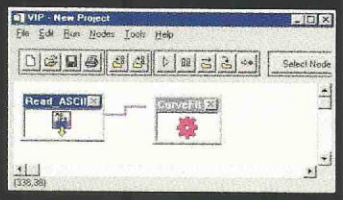

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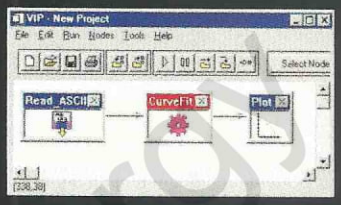

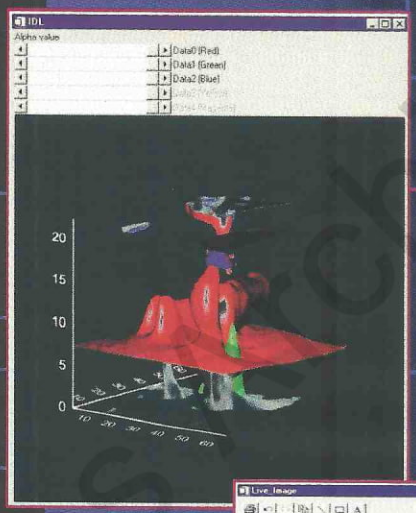

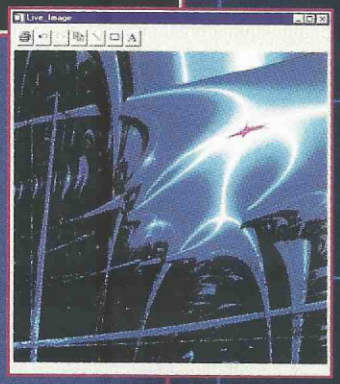

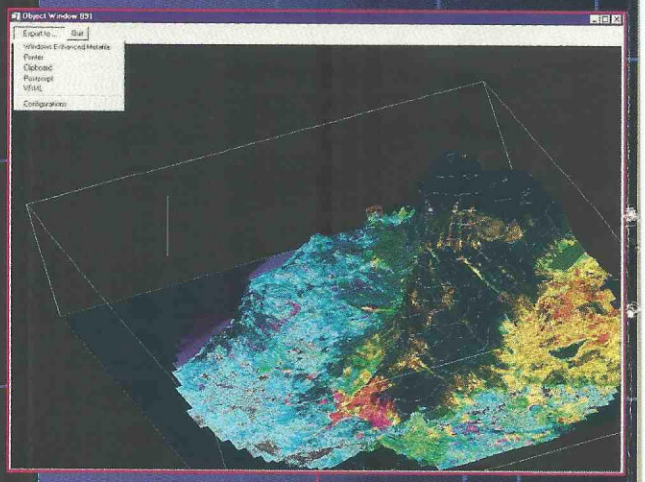

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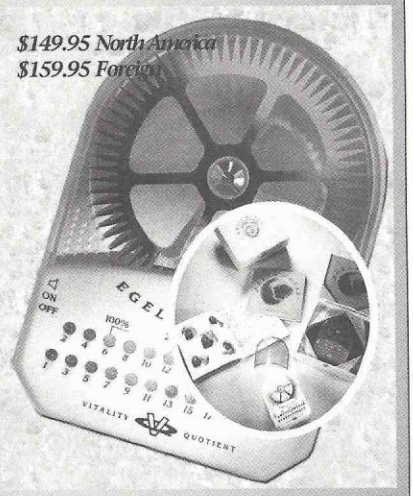

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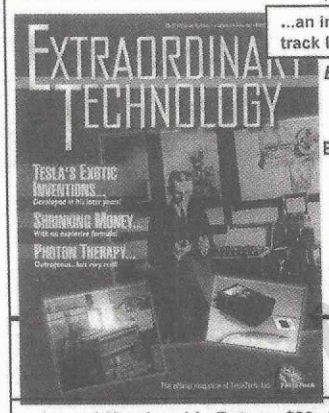

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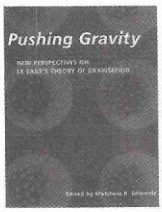

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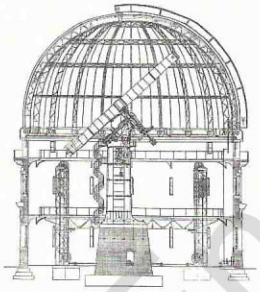

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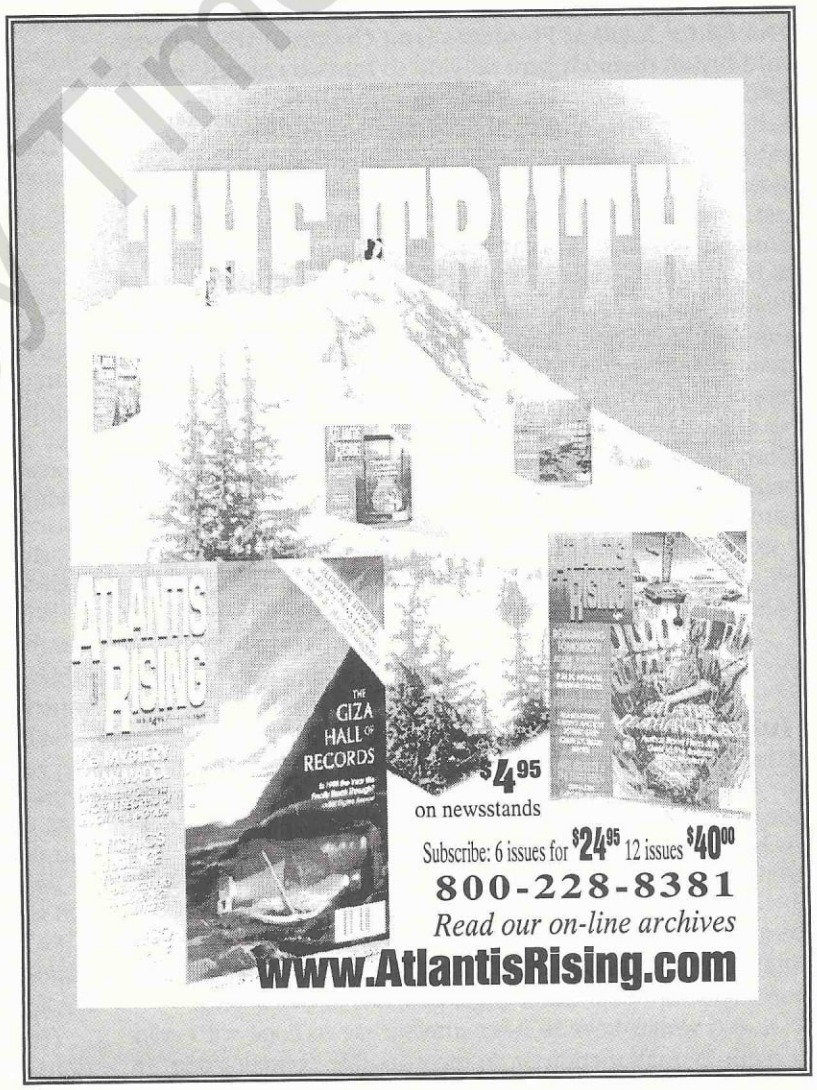

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LETTERS TO THE EDITOR

Dinosaurs Don't Get Research Dollars

The big losers in the cold fusion controversy are the physicists. Just in terms of hot fusion alone, physicists could lose billions of dollars in wealth if the government decides to fund renewable natural resources, cold fusion, fuel cells, and the elimination of nuclear wastes (aided, of course, by cold fusion technology), instead of their $15 billion toy. Solving the nuclear waste problem is critical to the rebirth of our nuclear industry, which will also depend on making it impossible for these reactors to melt down.

If models of the "soft" nucleus gain supremacy, then hundreds of scientists will become dinosaurs overnight. Dinosaurs don't get research dollars. Thus, they will lose power, prestige, and wealth. Is it any wonder that physicists are vehemently opposed to cold fusion?

Want to win a Nobel Prize for physics, chemistry, or peace? Then come up with a sink for the gamma rays not observed in the cold fusion process and come up with the mathematical modelling to make it work.

Richard Moody, Jr.
Berne, New York

The Editor Replies: Physicists (and chemists) who oppose cold fusion research generally do so for two reasons, which feed one another: 1) They do not believe that cold fusion/LENR experiments that show positive results are valid, (Of course, the critics have spent little or no time assessing those experiments, so their opinions are worthless.) and 2) they fear that if the general public and/or Congress come to believe that cold fusion research ought to be pursued, some of their research funding, *e.g.* for hot fusion, would be shifted to cold fusion—as $25 million almost was in the spring of 1989. It is remotely possible that a *very small* group of opponents of cold fusion research are actually beginning to believe that there might be something to the cold fusion experiments after all. However, it is virtually certain that in the present anti-cold fusion atmosphere most of these critics would lack the courage to step out of line and do the right thing. This is a great tragedy—not only for the progress of science, but for these few wavering critics individually. Yes, they're "losers," however that is defined. —*EFM*

Infinity is Still Longer Than a Very Long Time

Perpetual motion can never exist, be it by First or Second law violation. In the case of Second Law violation, this is not perpetual motion but heat reuse. A machine utilizing these cycles could exist in an isolated, closed environment but it would eventually wear down and fail. It would have to have intelligence to repair itself (or self propagate) but this couldn't be guaranteed for all time, as the materials it is made out of might get so diluted that it couldn't refine them within the constraints of the power it could generate in the system.

It also would have to have intelligence to cope with *every* scenario of malfunction or an incorruptible "genetic code" to churn out perfect new copies of itself once the old one wasn't worth repairing.

This is not perpetual but probabilistic.

Remi Cornwall
London, England

The Editor Replies: Yours is a clever, but somewhat legalistic criticism of First Law or Second Law-type "perpetual motion machines." I'll grant that First Law (energy conservation) violations are, in principle, forbidden, but that still allows a possible *apparent* violation, but not a *true* violation, as long as the vacuum state is deemed to contain conserved aetheric energy of some kind that is used to drive the machine. Second Law or First Law violators, of the type you describe that would need an "incorruptible" embedded replication code to run "forever," probably do exist already. These are known as biological organisms—life itself. Science has yet to accept that gross violations of conventional thermodynamics are inherent to biology. When it finally realizes this—an inevitability, in my view—the world of science will be turned upside down. However, the "incorruptible" genetic code, of which you speak, may not be possible—and is not desirable. There is no need for living organisms to remain "perpetually" the same. They evolve, but very likely not exclusively (or even approximately) in the random manner that is assumed to dominate "natural selection." If these remarks seem cryptic, they are intended to be so. Stay tuned for future elaborations. —*EFM*

Transmutation

Concerning the letter "Transmutation of Nitrogen" by James Wenskus, Jr. in *IE* #51: While it is true that atoms of nitrogen-14 differ from those of oxygen-16 and carbon-12 by one proton and one neutron, the change from one to the other also involves a change in the binding energy that holds the nuclei together. It is because of such differences in binding energy that nuclear transformations require or release energy on a scale that greatly exceeds that for chemical reactions. That is why the excess heat in "cold fusion" was interpreted by Fleischmann and Pons as indicating a nuclear process.

When two deuterium nuclei, atomic mass 2.014 each, combine to form helium, atomic mass 4.0026, 0.0254 units of mass are converted into energy according to Einstein's famous $E = mc^2$.

When two nitrogen atoms, each 14.0031, convert to an oxygen (15.9994) and a carbon (12.0000), mass of 0.0067 units is converted into energy. Though less by a factor of 3.75 than for deuterium fusion, this is still an orders-of-magnitude difference from chemical reactions.

Welders could scarcely breathe in all the gas in which nitrogen is supposedly converted to CO, so to damage their health, quite large amounts of CO would have to be formed. The corresponding release of nuclear energy could not fail to reveal itself, by melting of the metal if not by explosion.

The same difficulty applies to all of Kervran's suggestions about biological transformations: what happens to

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the energy released? Or, in other cases, where does the energy come from? (The fusion of atoms of elements lighter than iron releases energy, while the fission of heavier elements does so. Iron atoms have the highest binding energy per atom and are the most stable.)

Henry H. Bauer
Blacksburg, Virginia

The Editor Replies: I was well aware that on its face—*if* conventional understandings were accepted—there would be a large energy release. But, we are most certainly "not in Kansas" anymore on *any* of the LENR transmutation phenomena (and I am not saying that this particular claimed one is true). There are sources and repositories (sinks) of energy that are not mass-bound or electromagnetic—it's as simple as that. The current world view that all that exists (save "dark matter" and "dark energy"—which supposedly constitute over 95% of existence) is electromagnetic radiation and inertial mass has got to be wrong. That is saying a lot, I know. Yet all arrows point in that direction. We are very much, I think, in the midst of a Copernican-like revolution. We should live so long to reach the day on which this has been affirmed and become common knowledge. . . —*EFM*

Covert Forces of Orthodoxy

The covert forces of orthodoxy in all institutionalized systems of knowledge are without an ethos or morality; they are most like an organism—naturally self-aggrandizing and hostile to any incursion into their niche. Galileo would be made to recant today if his observations upset the corporate order!

Right after the first cold fusion news broke, I called a friend (the head of the physics department at a local university) and told him of what I had just read regarding cold fusion. His immediate answer was: "That can't be true; they are merely chemists, they are not even physicists."

William Glen
San Mateo, California

The Editor Replies: This illustrates the well-known phenomenon of physics chauvinism. But, sad to say, there are probably nearly as many chemists today who are as misguided as the anti-cold fusion physicists. Yes, institutionalized orthodox science is provably acting immorally against cold fusion research. The past fourteen years of the "cold fusion war" prove that the scientific establishment is not to be trusted when it comes to really frontier scientific discoveries. —*EFM*

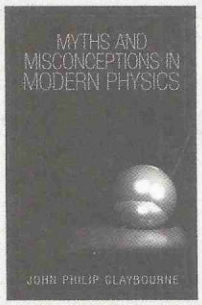
Errata

In Issue 51 of *Infinite Energy* (Joseph Papp engine special), the following errors were found:

The phone number listed for Heinz Klostermann was incorrect. The correct number is 650-571-6140. Mr. Klostermann was the author of two articles, "The Tangled Saga of the Papp Engine: Attempts to Revive It" and "'Lightning Harnessed': The Internal Plasma Expansion/Contraction Engine (IPECE)."

In the biography of author David Ansley ("The Dream Machine: One Man Took Its Secret to the Grave. But the Little Engine That Could Change the World Continues to Fascinate—or to Fool") it was incorrectly stated that the author currently works for *Consumer Reports*. He is presently product manager for the website www.BestTreatments.org.

Myths and Misconceptions in Modern Physics
by John Philip Claybourne



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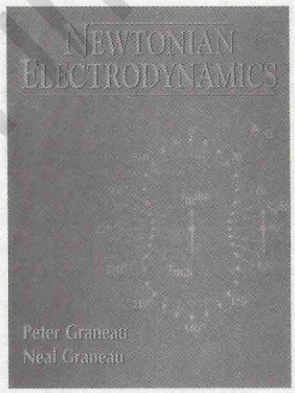

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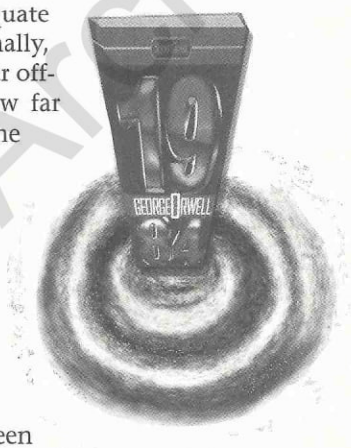
The Memory Hole at Work

by Eugene F. Mallove, Sc.D.

ICCF10, the Tenth International Conference on Cold Fusion, held in Cambridge, Massachusetts (August 24-29, 2003), has come and gone. It was little noted and may or may not be long remembered, but the aggregate message of its technical presentations and papers (many of these are now already posted at www.lenr-canr.org and can be downloaded for free) was staggering: It has been proved beyond reasonable doubt that some profoundly new adjustments must be made to "accepted physics"—and to accepted chemistry, for that matter. What can only be described as definitive modern alchemy experiments have been published, re-examined, duplicated elsewhere, and are now offered to the world to take them or ignore them. It will be mostly the latter.

The Memory Hole of Establishment Science gobbles up this kind of knowledge and ensures its oblivion. The "Memory Hole," of course, first made its appearance in George Orwell's 1949 book *1984*, about a totalitarian dystopia in which the manufacture of falsehood is central to the socially imposed mind control. Lead character, journalist Winston Smith, works in the Records Department of the Ministry of Truth, an agency charged with purveying the antithesis—falsehood. Smith speaks his articles into the "speakwrite" device, which also deposits these into the Memory Hole—supposedly to be recorded, but actually to be forgotten and destroyed! In the *doublethink* world of *1984*, many things such as Memory Holes are named for their opposites. Similarly, the Orwellian world of Establishment Science professes extreme interest in frontier discoveries, but is actually in the business of patching up old theories and justifying and forgetting the contradictions between both old and new experiments with these old theories. The Establishment names such frontier scientific fields as LENR "pathological science," while its bigoted pathology in doing so is dubbed "keeping the House of Science (the Ministry of Truth?) free of falsehood."

How does the Memory Hole of Establishment Science work, and is its operation more widespread than even the attendees of ICCF10 might have imagined? The Establishment has moved the goal posts for the science of low-energy nuclear reactions (LENR, a.k.a. "cold fusion") many times. First the Establishment demanded definitive calorimetry for the large magnitude excess heat, and that was done—and it was ignored and forgotten. Then the Establishment demanded strong evidence of "nuclear ash," and that was done—and ignored and forgotten. The nuclear ash—helium, tritium, energetic charged particles, heavy element transmutations—didn't at all fit textbook theories; so it had to be erased from adequate public discourse, and it was. Finally, the goal posts were moved so far off-planet, that few could see how far they had been moved. In the immortal words of MIT Plasma Fusion Center physicist Richard Petrasso (*Popular Science*, August 1993, p. 82): "I guess I'll believe it [*i.e.* "cold fusion"] when someone drives a car up here from New Jersey." That's where the goal posts have been for the last thirteen years. The small-minded, arrogant Petrassos of this world, who are lavished with billions of dollars of tax money (and they still cry "poverty") are the paid assassins of new science. They are everywhere. Their messages are conveyed to mostly supine science journalists and the imbeciles who call themselves "scientists" believe the propaganda.



The Scientific Establishment has had almost fifteen years to come to terms with LENR, and it has failed very, very badly. I'd give it an F- grade for its intellectual performance, but there is no grade low enough to characterize its immoral behavior. But there is so much else—within physics especially—that is deeply rotten. This issue of *Infinite Energy* highlights only three such domains. There are many more. Are there giant cracks in the foundations of physics? No doubt at all, but the Memory Hole has been busy liquidating the evidence, but we have no fear in publishing it again and again.

First we have the case of LENR and this travesty: A landmark scientific meeting, ICCF10 (see p. 9), which was held within spitting distance of MIT, and well advertised, yet not a *single* MIT professor chose to attend (other than the two MIT professors who have been involved with the field from the beginning). A good size ad was placed in the *Boston Globe*, at the personal expense of ICCF10 Chairman, MIT Professor Peter Hagelstein. About 200 posters were placed on the MIT campus. The *Boston Globe* and the *Boston Herald*, duly informed in advance of this meeting, deliberately chose to ignore ICCF10—this despite urgent calls from the office of Prof. Hagelstein, and later even as *two* different excess power-producing experiments were underway at the time. Both newspapers were specifically called (by me) to that scientific event *while it was happening*. What of the vaunted MIT News Office—the PR wing for the MIT Administration—which never tires of flacking every new

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money grant to MIT and every professorial award? Not there, out to lunch. What about *MIT Technology Review*, a supposedly world class magazine—"MIT's Magazine of Innovation," it calls itself on its cover? Did it send a representative to find out what was going on? No.

An MIT graduate, Ron Dagani, who had migrated to science journalism and has held a long-standing position at the American Chemical Society, chose not to come to the meeting or to send a representative, though he had written some fairly balanced articles on LENR in the early 1990s. The buck was passed to a new face, who did not attend, but he had no trouble blathering vacuous lines for the ACS pre-ICCF10 press coverage. In his article "Science, Religion, and the Art of Cold Fusion" (*Chemical & Engineering News*, August 23, 2003, p. 33), senior editor Stephen K. Ritter wrote, "The research community at large now dismisses the ongoing research as 'pathological science,' yet cold fusion researchers continue to maintain a genuine, optimistic belief that they are doing good work and that it's worth pursuing. Why?. . .If one adheres rigorously to the scientific method, the research community should reserve final judgement as long as research in this area continues. Cold fusion researchers, though marginalized, thus continue to pursue their work. But why do they choose to do so? Obviously, they still have hopes for their research, but their persistence could justifiably be considered a leap of faith. . .New data being reported at the cold fusion meeting this week may or may not provide some answers." Mr. Ritter obviously had a leap of faith that ICCF10 would provide no new insights for him to absorb, hence his poor attempt to "cover" ICCF10 by precognition and remote viewing.

David Brooks, a friendly New Hampshire journalist, honorably let his southern New Hampshire audience know about ICCF10 in advance of the meeting. But though invited, he did not attend the meeting himself. He offered this opinion (*Nashua Telegraph*, August 20, 2003, pp. 11-12): "My bet is that cold fusion will turn out to be, at most, an interesting anomaly. I say this not for good laboratory reasons—the technical arguments are w-a-a-ay over my head— but because I think the scientific establishment does a pretty good job of sorting the wheat from chaff. It's had some spectacular flops but, in general, produces many more hits than misses. If science says cold fusion doesn't exist, I believe it. I hope I'm wrong—table top power generation would be a wonderful thing, but until Dean Kamen starts selling Segway II With Cold Fusion, I'm a doubter." There you have it, the doublethink organs of Establishment Science at work. Brooks has even subliminally assimilated the tonality of Petrasso's 1993 exclamation, but the car with New Jersey plates has become a New Hampshire "Segway II."

"Many more hits than misses"? Well, now let us see. Einstein's Special Theory of Relativity (SRT) has become so sacrosanct, as an example, that one cannot challenge its fundamental validity without being called a crackpot by the Establishment. Even more sad, but unfortunately true, there is little doubt that greater than 98% of the cold fusion scientists attending ICCF10 have no stomach for investigating whether their excess heat results just might have bearing on SRT's well-documented shortcomings. The Mainstream Cold Fusion Hypothesis (MCFH), which I critique in my web-posted ICCF10 paper (www.infinite-energy.com/resources/iccf10.html), requires that the LENR excess heat be commensurate with the nuclear ash, in the $E = \Delta mc^2$ sense, where Δm is the mass-deficit of the presumptive reactions. There is no proof of this contention (though it was an initially good guess for what the "cold fusion" phenomenon might be), but the vast majority of cold fusioneers rather blindly persist with that paradigm, to the exclusion of all others. It may well be a blind alley. After all, even Randell Mills and his colleagues at Blacklight Power Corporation and elsewhere (no doubters of SRT, they!) have shown large magnitude excess heat in hydrogen systems that does not appear to have a nuclear origin *per se* (see comments in my posted ICCF10 paper).

But back to Einstein's foundational claims. It has often been inferred or stated, by introductory and advanced SRT texts, that the curious phenomenon of *stellar aberration*, a discovery of early eighteenth century astronomy connected with the apparent shift in the position of stars due to Earth's orbital velocity, was in part a motivator for Einstein's revision of all our concepts of time and space. But as Tom Phipps reveals in his article, "Failures of Relativity Theory to Describe Starlight" (p. 36), modern physics has obscured its inability to deal with something as basic as the apparent *direction* of light from stars, as it is affected by the *motion* of Earth. Phipps shows that SRT apparently can't even explain a phenomenon of light that was discovered and "explained" classically almost three hundred years ago: the apparent change in the direction of a star through the year due to Earth's orbital speed (about 30 km/sec) and its fractional relationship to the speed of light (about 300,000 km/sec).

The propaganda from the Relativity establishment's Ministry of Truth is that SRT's alleged complete explanation of stellar aberration provides another reason to accept the theory! Down the Memory Hole went many long-discussed concerns that SRT could not be said to have been "proved" via the phenomenon of stellar aberration. It obviously can't be, as Phipps shows, because the proof of even the *compatibility* of SRT with star direction measurements lies buried in the magnitude of the second-order term—the v^2/c^2 term— which evidently has yet to be measured by the radio astronomers.

Then we come to Sacred Thermodynamics and its supposedly inviolable Second Law, numerous statements of which suggest that sensible thermal energy can never be converted with 100% efficiency to useable work. In the words of Science Establishment's apologist, fast-talking Robert L. Park, "The first law says you can't win; the second law says you can't even break even" (*Voodoo Science*, p. 7). If Park's assertion is on such solid ground, why did the American Institute of Physics (which he represents) publish the conference proceedings, *Quantum Limits to the Second Law: First International Conference on Quantum Limits to the Second Law* (San Diego, California, 2002, AIP Conference Proceedings #643, Editor, Daniel P. Sheehan, 507 pages)? If Park were to glance at this book—it is doubtful that he has—he'd find something else to mock in his weekly buffoonish "What's New" web columns—many of the scientists at this conference discussed concrete proposals for the macroscopic violation of the Second Law. The book's title was cleverly designed by Sheehan to fly under the Parkian radar.

Infinite Energy is proud that its efforts add to this corpus of massively building evidence that the Second Law needs to be junked. In "The Demon Trapped" (p. 19), I recount how my colleague Kenneth Rauen at New Energy Research Laboratory (NERL) has experimentally confirmed a spectacular, heretical

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prediction about heat and work that was made years ago by a perceptive scientist, Wayne Proell. Ken's article, "The Proell Effect: A Macroscopic Maxwell's Demon," follows my introduction. Let me highlight the gist of what I wrote: The experiment has been repeated hundreds of times with all manner of control experiments. I am certain that the Proell cooling effect documented in Ken's article is real. Anyone duplicating this experiment will immediately and repeatedly observe the effect—and we hope that others do confirm it, though the experiment itself is so well-documented and bulletproof, that there is not a great need for widespread duplication. This is not like LENR, where the very theory underlying the effect is not known. In this case, the theory behind what causes the Proell Effect—it should probably now be termed the Proell-Rauen Effect—is completely known. It had just been overlooked. Ken and I remain convinced that this astonishing Proell Effect (which leaves one breathless when one first sees it), embodied in appropriate technological designs, will indeed lead someone, somewhere—if not via Ken's own hands and blood and sweat—eventually to the infamous "Perpetual Motion Machine of the Second Kind." This is a device that can extract the kinetic energy of molecular motion from the environment and turn it into macroscopic technological work—without a lower-temperature reservoir into which to dump waste heat. In other words, a nearly perfect free energy device.

Alright, if you are tempted to accept all or much of what I have written above, where does that leave us on the road to a world run on truly *new* energy sources? Perhaps not that far. Remember, the Memory Hole is at work! *Infinite Energy's* voice (the magazine, its website, and conference and radio appearances by yours truly), as well as all the other efforts to raise the concept of new energy to high public profile—websites, downloadable free information, demonstration of prototype devices before commercial entities, discussions with all manner of venture capitalists—has not yet resulted in the resources or public awareness to put us all where we need to be. Science reporter Sharon Begley of the *Wall Street Journal*, who attended the first two days of ICCF10, did write a complimentary opinion piece in her "Science Journal" (September 5, 2003, p. B1). The banner of her column, "Cold Fusion Isn't Dead, It's Just Withering from Scientific Neglect," serves to summarize the state of affairs with LENR but could serve as well to characterize the Establishment reception of other prospective new energy sources. Ms. Begley wrote, "What these claims need is critical scrutiny by skeptics. That is how science normally functions. But in Cold Fusion, it isn't. And that's the worst pathology of all." At another point she wrote perceptively, "But the real pathology is the breakdown of the normal channels of scientific communication, with no scientists outside the tight-knit cold fusion tribe bothering to scrutinize its claims."

On September 25, 2003, ICCF10 Chair Professor Hagelstein of MIT wrote an urgent letter to U.S. Secretary of Energy Spencer Abraham, which we have reprinted in full (p. 45). It asks for a new official review of the LENR evidence, as it has built up since the 1989 negative review by a DOE panel. It has come to my attention that as a result of Hagelstein's letter, such a review is at least being "considered" at high levels within DOE. Let us hope for a turnaround that could give impetus to LENR research, as well as to other new energy source proposals, such as vacuum state energy and reconsideration of Second Law mythology. These are inextricably linked to LENR not only for reasons of fundamental physics, but in their deeply heretical, physics-busting character—the opinions of certain outspoken cold fusioneers notwithstanding. I am pessimistic that DOE will be persuaded to conduct a review of LENR—the sharp knives of opponents are out already to prevent such a review. And, even if a DOE review were to occur, I have little confidence that an honest appraisal would be rendered. The DOE ratify modern alchemy? No way! Not only would the hot fusion budget be at risk as it was in 1989, but this time—and in high profile—also the Energy Establishment (not only oil, coal, and natural gas, but also solar and wind power). And, the very foundations and self-satisfied assumptions of Establishment Science, as well as its political power, would be in great peril. I bet heavily that the DOE review does not happen, and that if it does it would be conducted dishonestly as was the first one in 1989. But in this one case, I would just love to be proved wrong! ❐❐❐

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Dr. Eugene F. Mallove
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Review of the Tenth International Conference on Cold Fusion (ICCF10)

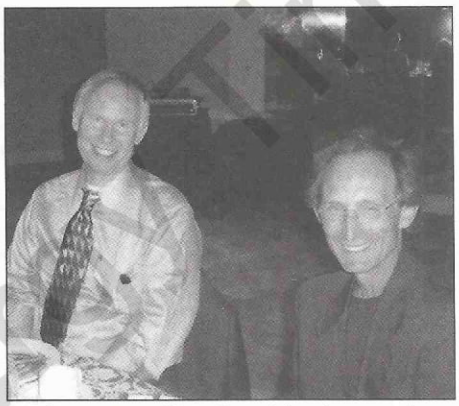
Eugene F. Mallove

Here We Go Again. . .

It has become a familiar pattern for those of us in the beleaguered "cold fusion" field, which should be termed by now, much more appropriately, the Low-Energy Nuclear Reactions (LENR) field. (But the *cold fusion* nomenclature, with which the field began, is probably unavoidable and will be used interchangeably with LENR.) The time of the new conference approaches. We anticipate another International Conference on Cold Fusion (an "ICCF"), which have come at intervals as short as about a year, and as long as two years since the heyday of cold fusion, when the first one was held about a year after the Fleischmann-Pons announcement of March 23, 1989. It was in Salt Lake City under the auspices of the now defunct National Cold Fusion Institute—gone, but most surely *not* because of faulty science.

The months shrink, papers are written, experiments completed, travel plans made, and conference registration applications filed. We are ready for a new adventure; we look forward to meeting old friends on the frontiers of science, at a nexus where fundamental errors of physics and chemistry—and, many believe, even within biology—have now become glaringly apparent.

We know what is about to happen: Astonishing results in excess heat will be revealed by scientific teams from around the world. The better papers that will be presented at the ICCF, which are the vast majority of them now, find irrefutable evidence of excess heat that cannot be explained by ordinary chemical reactions—its magnitude is far beyond explanation by ordinary chemistry. Other papers—equally good, if not generally better—find overwhelming evidence for nuclear emanations and transmuted heavy elements. These findings come from the same or similar presumptively *chemical* systems; they were obtained using standard laboratory nuclear radiation detectors, as well as element and isotope detection devices. We have entered the age of modern alchemy and we know it. But for the most part, the world will not be listening. Important as these results are to the future of science and technology, we who will be attending the new ICCF, and who will be *attempting* to transmit this precious knowledge to the world, will be ignored and/or attacked and mocked, as though we had some kind of embarrassing disease.



Conference Chair Peter Hagelstein with Vittorio Violante.

In fact, the enemies of this startling new scientific knowledge have a name for the alleged sickness: "pathological science." It transpires that these name-calling Scientific Establishment bigots (there is no better term for them) are the ones who have the *real* malady—*pathological skepticism*. This is proper scientific skepticism that has run amok; it is an uniformed skepticism that refuses to be moved *by any and all evidence* from its initial and proper doubt concerning a novel phenomenon. The pathology is so deep that *no* new evidence is even glanced at by these *pathological critics* (Martin Fleischmann's term). The evidence is just ignored. And—the heavens cry out against this injustice: this patently anti-scientific behavior receives the cover and support of almost the entire science journalism establishment. We end each conference with hope for the next one, that there will be vindication in one form or another. Scientific progress has been made, but we have not changed many closed minds. One rightly asks whether there can be much hope for this field? Perhaps, because where there is life and struggle there is hope. But overcoming the vicious opposition will not be easy. After all, it has been for almost fifteen years very much like this. Only the death or disinterest of this or that pathological skeptic, *e.g.* respectively Douglas Morrison of CERN and Robert Park of the APS, has changed.

ICCF10: Cold Fusion Returns to MIT

The latest international LENR conference, ICCF10, took place from Sunday, August 24 through Friday, August 29, 2003 at the Royal Sonesta Hotel in Cambridge, Massachusetts, less than one mile from MIT; there were also demonstrations of excess heat-producing LENR experiments conducted at MIT. From the early days of cold fusion, my wayward alma matter MIT became known as a "bastion of skepticism," though several MIT professors adopted a positive, open-minded stance and two have been involved in research and theory since the beginning. (See my editorial "Cold Fusion Returns to MIT," *Infinite Energy*, #47, pp. 7-10, and also my 55-page report "MIT and Cold Fusion"— available in PDF format at www.infinite-energy.com/, and in *IE* #24, pp. 64-119.) According to professor Peter L. Hagelstein, a long-time LENR theorist from the MIT Department of Electrical Engineering and Computer Science (EECS), who was Chair of ICCF10, some 150 attendees gathered for all or part of the intense week-long program: scientific talks, poster sessions, demonstrations of excess heat experiments at Hagelstein's EECS office, and one other demonstration conducted remotely in Texas and viewed live via Internet connection during a plenary session. The *very strong* demonstration component was perhaps the most striking departure of ICCF10 from most previous ICCFs, though Clean Energy Technologies, Inc. (CETI) of Sarasota, Florida presented a strong electrolytic excess heat demonstration at ICCF5 in Monte Carlo, Monaco (1995) and Dr. R. Notoya conducted a less strong demonstration of excess heat at ICCF3 in Nagoya, Japan (1992).

Most ironic was the active participation, at least at a purely administrative level, of "MIT Conference Services," the official group within MIT that handles registration and other conference mechanics-related matters for MIT professors and other campus groups that hold conferences. It must have been these fine people who naively put signs on the entrance to the main conference hall that read: MIT 10th International Conference on Cold Fusion.

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We are in the Internet Age, to be sure. Unlike all earlier conferences, soon after ICCF10 a great information outburst erupted. Delivered technical papers, poster presentations, and even Power Point slide shows used by ICCF10 participants began appearing for free downloading at the exclusively "cold fusion"-focused website, www.lenr-canr.org. As this brief ICCF10 review was in preparation in late October 2003, there were already posted some 55 technical presentations, with many more to follow. Within one year of its birth this site registered downloads of some 250,000 PDF-format and other format technical papers. This is bound to have a salutary effect on the growth of interest in LENR studies.

At ICCF10, I personally video taped all of the talks and discussion sessions (minus the pre-conference "cold fusion short course" held on August 24) with a portable Sony digital camera. Initially I had not intended that this tape would be used for any purpose other than reviewing scientific aspects of the conference in the future, and for helping to prepare this report. But when it became clear to me that ICCF10's presentations were unusually strong, we decided to put all of these "mini-DV" digital tapes on a set of DVDs and distribute them to anyone willing to pay the nominal cost for producing them and shipping them. So, if readers wish to order a set of the eighteen (yes, 18!) DVDs—approximately 36 hours of content that is indexed on accompanying paper program guides by conference speaker name and DVD "chapter number" (accessible by ordinary DVD player controls)—they may do so at the website of New Energy Foundation, Inc., www.infinite-energy.com.

Alternately, simply send payment of $130.00 to New Energy Foundation, Inc., P.O. Box 2816, Concord, NH 03302-2816. *Shipping is included in this price*—to domestic or foreign destinations. We will begin sending these out in late November or early December 2003, so please order promptly to reserve your place in the order-placing queue.

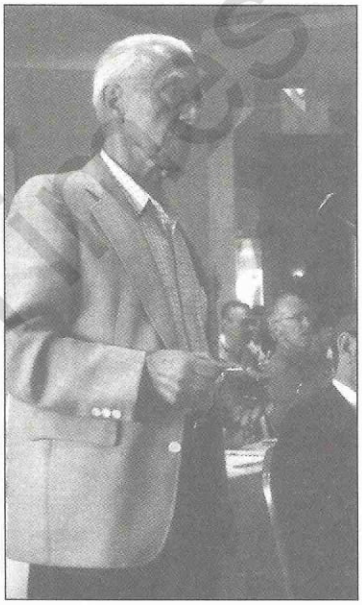
In the last issue of *Infinite Energy*, I editorialized about some highlights of ICCF10—these were quickly assembled as we went to press with our last issue; they are worth re-examining. But there is much more, now that I have had the time to reflect on ICCF10 and review some of the full papers already posted on www.lenr-canr.org. But a detailed review of all the available papers is not warranted, since so many of them are now readily web-accessible.

In my view, there were three absolutely fundamental scientific high points, though this is not to detract at all from the many other thoroughly revolutionary works reported:

1. Laser-Driven Excess Heat "Weapons": What is now being called the Letts-Cravens Effect—excess heat stimulated by laser light irradiation of cold fusion electrolytic cell cathodes (see *IE* #50, pp. 10-15)—has now been independently observed by three outside groups: Dr. Michael McKubre of SRI International, Dr. Edmund Storms in New Mexico, and Dr. Mitchell Swartz in Wellesley, Massachusetts. Low-level laser light power is input and a huge power excess emerges, for example: 30 milliwatts input, 1 watt output (a 30-fold multiplication of input power), though this now rides on top of a much higher electrical input power that is initially in thermal balance (*i.e.* no excess). This is evidently a highly repeatable effect—one that has the potential of breaking through into numerous other labs around the world.

2. Mitsubishi's Modern Alchemy: The astonishing nuclear transmutation experiment carried out by the Iwamura group at Mitsubishi Heavy Industries Advanced Technology Division, which was reported in *Infinite Energy* (#47, pp. 14-18) and later published in the *Japanese Journal of Applied Physics* has now been reproduced by the A. Takahashi group at Osaka University, and reconfirmed by MHI's lab in other ways. In this experiment, deuterium (heavy hydrogen) gas is made to flow through a palladium membrane onto which another element, such as cesium or strontium, has been deposited. With no energy input (other than the pressure of the gas) the deposited element transmutes to another element. For example, cesium declines and the rare earth element praesodymium appears and grows. Or, strontium declines and molybdenum grows. The term "grow" is appropriate, since to make the new elements it is necessary for the starting nuclei to "absorb" four deuterium nuclei! Obviously, this flies completely in the face of every cannon of basic chemistry, but the evidence for the result is now overwhelming. It is nothing short of modern alchemy.

3. The Oriani-Fisher Bombshell: One of the most paradigm-busting sets of papers that were presented at ICCF10 is by Drs. Richard Oriani and John C. Fisher. Using CR-39 particle track detectors immersed in Li_2SO_4 dissolved in heavy or light water, and using Ni and Pd cathodes, they conclude: "There is a causal relationship between electrolysis and energetic charged particles and that neither Pd nor D_2O is essential for the generation of a nuclear reaction." In John Fisher's separate theoretical paper concerning this experiment he reports, "A theoretical basis is offered for the remarkable observation by Oriani and Fisher of a shower of about 250,000 energetic charged particles that occurred in the vapor of oxygen and hydrogen evolved from electrolysis. The shower was localized in space and time, originating a few millimeters above the surface of a plastic detector chip and lasting for a few seconds. The responsible nuclear reactions must have been sustained by the vapor." Fisher's polyneutron theory, which suggests that polyneutrons are omnipresent in the environment, has this implication, Fisher says: "The theory suggests that a single polyneutron can ignite a chain reaction that is sustained by ^{18}O as fuel." The paper has been submitted to a prominent mainstream journal; it will surely be rejected outright, for no good cause. To me, this experiment looks bullet-proof, though the theory may not be correct. In this experiment we are far removed from the notion of lattice-based nuclear reactions—are we not? Why not then consider even more radical theoretical medicine than the metal lattice dynamics that have been the staple of so many "mainstream" LENR theories?


Richard Oriani

The foregoing constitute merely my view of the three highest scientific peaks, among many other towering moun-

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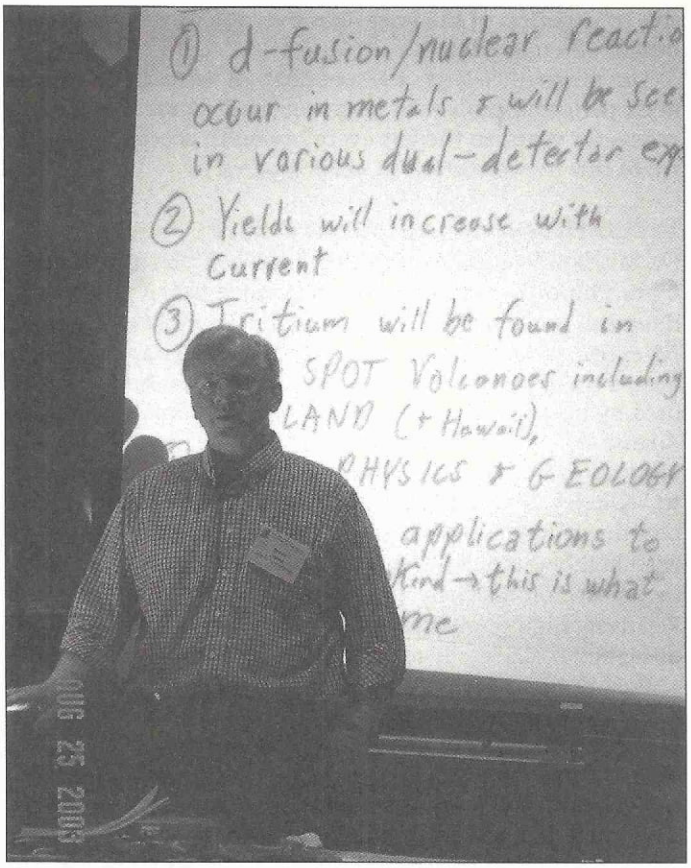

Steve Jones

tains. Now to proceed a bit deeper to discuss other remarkable happenings at ICCF10.

The Short Course Kick-Off

A useful introduction for newcomers to LENR, and a productive review session for old-timers, was the "Short Course on LENR" that was held in a jam-packed smaller conference room all day Sunday, August 24. Most appreciated were the compendious paper hand-outs that were provided by the "Cold Fusion Professors": John Dash, Peter Hagelstein, Mike McKubre, George Miley, Ed Storms, and Akito Takahashi. The concisely stated course objective: "To provide an introduction to the field for persons interested in gaining a basic background in the science and technology aspects. Both theoretical and experimental topics will be covered for deuterium and proton based reactions."

Participants later segued into the traditional Sunday evening welcoming reception, which was made complete with a pleasing view of the famous Charles River that separates Boston from Cambridge. The very fuel of the future—water—which was the subject of this and past ICCFs, was thus again an immanent backdrop to the deliberations. One could imagine the yachtsmen and women cruising by, their world view deeply vested in conventional energy, but few of whom could suspect what was being contemplated a mere tens of meters from their water-sprayed windshields.

The Return of Steve Jones

Those who recall the history of cold fusion understand the major role played by physics Professor Steven E. Jones of Brigham Young University. It was he and his colleagues at BYU who had long had an interest in the generic possibility of "cold fusion" occurring within the body of Earth, and in so-called muon-catalyzed "cold fusion," which had even been the title of a *Scientific American* article by Jones in July 1987. Jones *et al.*, in parallel with Drs. Fleischmann and Pons at the University of Utah (only some 45 miles away), had performed electrochemical experiments that led in the spring of 1989 to public reports of scientific anomalies from electrochemical cells, after the somewhat pre-emptive announcement by the two University of Utah professors of excess thermal energy production. Whereas Fleischmann and Pons had focussed their attention on precise calorimetric measurements of excess heat from pristine heavy water-LiOD cells with Pd/Pt electrodes (though they had also announced neutron and tritium measurements), Jones at that time was using a "Mother Earth Soup" of materials in a Pd/Pt electrolytic cell in an effort to mimic conditions within the Earth. He dealt exclusively then with nuclear measurements, specifically the signatures of neutrons emanating from his cells. Neither Jones nor Fleischmann and Pons were believed by most mainstream physicists—then or now, but Jones' claim being the "more believable," fared better in the press in the early days. Bitter rivalries emerged and Jones, in particular, became an outspoken opponent of excess heat findings, but he never went back on his belief that his cells were giving off low-level neutrons. It turns out that *both Utah groups* were basically initially on the right track.

It was thus an honorable form of "closure" that Steve Jones attended ICCF10, after a long absence (since roughly 1993) from such gatherings. He was given the great privilege of giving the first plenary session talk at ICCF10, and he did not disappoint us. He produced what appear to be nearly unassailable scientific evidence of nuclear emanations from presumptively chemical systems. Even these very low-level nuclear radiations—charged particles as well as neutrons—are still regarded as impossible by establishment physicists. Later during ICCF10, as others presented their astonishing work to complement that of Jones and also of Fleischmann and Pons, it was evident from Jones' generous statements about the entire conference that his horizons had been expanded. He remarked, "I am learning that there can be many miracles. . ." Perhaps his full public acceptance of excess heat results, in the context of his own results, will eventually occur.

Helium Results

Examining several abstracts presented to ICCF10, and listening to some of the pertinent talks, suggests that uncertainty remains about whether the helium production rate in heavy hydrogen experiments is strictly commensurate with excess energy. One of the very best investigators, Dr. Melvin Miles, writes in his abstract[1]: "Furthermore, the rate of helium-4 production was always in the appropriate range of 10^{10} - 10^{12} atoms per second per watt of excess power." The "yes or no" helium correspondence with excess heat production cannot be denied; he puts the chance that it is in error at 1/750,000—a fantastic experimental accomplishment. But the failure to pin down commensurate ^{4}He with excess heat within less than two orders of magnitude is troubling. We also have the ICCF10 abstract of the Italian group of A. DeNinno *et al.*, "^{4}He Detection in a Cold Fusion Experiment."[2] The researchers indeed appear to have found anomalous ^{4}He (by "a factor of about 20 out of baseline"),

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High school students who have been working with John Dash at Portland State University demonstrate excess heat at MIT.

but they appear not to have an accurate assessment of its correlation with excess heat for they can only "estimate, at the present time, a lower bound for the produced energy." Dr. Emilio DelGuidice, who presented the wonderful results for an absent Dr. DeNinno, nonetheless had to make some hand-waving arguments about why the ^{4}He measured was low by a factor of about 20.

The Letts-Cravens Effect and Demonstration

At ICCF10, Dennis Letts gave an historic, live conference demonstration of laser-triggered excess heat in a palladium-heavywater cell. But the active Letts-Cravens cell actually resided in the Austin, Texas laboratory of EarthTech International (ETI), and was witnessed by the conferees via an Internet web camera link projected onto a large screen. It was a moment of high drama.

We were told by Dennis Letts that this may be the first over-unity experiment that the famously skeptical Scott Little of ETI may eventually "bless," after Little performs the test with his very own apparatus. He is said to be quite satisfied already with the Letts equipment. We shall see whether any kind of formal support for this important result will be given by this facility, whose director Dr. Hal Puthoff (a "zero point energy" theorist) claims an association with potential supporters of such over-unity technologies (believed to be in Europe), who have, in Puthoff's words, "very deep pockets."

Ed Storms has not only reproduced the Letts-Cravens effect in his own lab, measuring it with a sensitive Seebeck calorimeter. He has also discovered that *reversing* the Pd cathode and Pt anode in Fleischmann-Pons cells enormously enhances the reproducibility of the phenomenon! He acknowledged that stating this was as "heretical as saying 'cold fusion is real' at an APS meeting." He commented, "Since I reversed the electrodes, it is almost impossible *not* to get excess heat. . .The irony here is overwhelming." He presented graphs which showed that the Letts-Cravens excess heat effect and the Fleischmann-Pons excess heat effect seemed to be independent of one another. He also found that the effect was insensitive to variation of the laser light over the wavelength range 680 to 686 nanometers.

Dr. Mitchell Swartz, independent of Letts-Cravens, has been performing his own laser-triggered excess heat experiments for years, so there is every reason to accept the viability of this new direction in LENR studies.

Excess Heat Demonstrations at MIT

Dr. Mitchell Swartz's Fleischmann/Pons-type electrolytic palladium Phusor/low-electrolyte conductance heavy water/palladium cell performed flawlessly in Prof. Hagelstein's lab at MIT. Its excess power ranged from 167% to 267% as Dr. Swartz altered the experimental conditions. This excess heat, as measured by his precision calorimeter, persisted from August 24 to August 30, longer than ICCF10 itself. The excess heat was interrupted on the last day only to bring the equipment back to Wellesley, Massachusetts— otherwise it would have continued much longer. In my view, Mitch Swartz's unique work with highly purified heavy water and no added salt is among the most commercially promising approaches in the field. Relatively high power ratios—now circa 1 watt in, 3 watts out or higher—come easily to him.

Prof. John Dash of the physics department at Portland State University in Oregon and his summer high school student interns also put on historic demonstrations of excess heat at Prof. Hagelstein's lab. They used simple but effective calorimetric apparatus, which allowed observers to check the level of excess heat for themselves. Large numbers of ICCF10 conferees drove or walked to MIT to participate in these demonstrations. It was a really boisterous "happening"—as one might have said in the late 1960s. Unfortunately, urgent calls to the local press to view and report this remarkable and historic event had no effect. The press was not interested. A tragedy, an obscenity.

The New Patterson-Thompson Cell

Dr. James Patterson of Clean Energy Technologies, Inc. has been one of the most prominent and creative of LENR scientists. At ICCF10, he and his colleagues who work in Sarasota, Florida revealed a stunningly simple, robust, and ingenious gas-phase cold fusion reactor, which has produced apparent excess heat for months on end. First Dr. Patterson described the history and evolution of his metal film-coated bead excess heat cells, which were electrolytic water flow-through cells. These have been put aside in favor of a new design that will not be subject to the metal film damage problems of the bead cells. John Thompson then discussed their new deuterium gas cell, which was initially based on a ceramic and palladium matrix, but which then evolved to a diatomacious earth/palladium structure. The silicon dioxide skeletal structures from ancient microscopic life being used for twenty-first century power! These direct current-activated cells appear to produce about 50% or higher excess power, which is inferred from temperature measurements on the cell casing, when a fixed charge of D_2 gas is infused into the cell. This is compared to the temperature when air infusion of the same cell is employed as a control. The team agrees that actual calorimetry, not merely comparative temperature measurements, should be performed, and it will do this.

Israeli Company Launches Intense LENR Program

A very big surprise at ICCF10 was the unexpected presenta-

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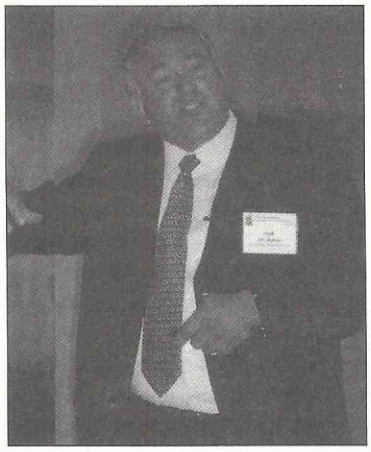

Arik El-Boher

tion by Dr. Arik El-Boher of Energetics Technologies Ltd., which is based in Omer, Israel. El-Boher was one of about a half-dozen individuals who were representing the company at ICCF10. It was obvious from the lavish equipment displayed and the multi-system parallel-cell testing approach being taken that a very intense program of research aimed at power generation is underway. El-Boher revealed that the company was pursuing four basic approaches: glow discharge heavy hydrogen gas systems; electrolytic cells; gas loaded catalytic cells, and high-pressure cells with ultrasonic wave excitation. The research has already led to substantial excess power generation in gas discharge cells, encountering the heat-after-death phenomenon, and the production of tritium. One of the company's cells had been producing significant excess heat continuously from June 2003 to the time of ICCF10 and beyond! All this was especially surprising, since the Israeli group, several of whom had attended ICCF9 in Beijing, seemed at that time to be only at the exploratory stage. The work is funded by a group of U.S.-based investors. One of the group's driving members is an American physician, Dr. Irving Dardik of Califon, New Jersey, who has made a name for himself in the treatment of various illnesses using special "SuperWave™" or "wave within a wave," multi-spectral stimulations. According to El-Boher, this type of input power waveform was being used to good effect in the LENR experiments being carried out in Israel. The company has already cooperated technically with the government-funded ENEA group in Italy, and there is evidence that cold fusion researchers in the U.S. are also beginning collaborations with Energetics Technologies. This appears to be a multi-million dollar private new energy effort, matched in organization and financing, only perhaps by New Jersey-based BlackLight Power Corporation.

Transmutations in Biological Systems

We must take note of the increasing appearance of reported and reproduced transmutations of elements in biological systems. At least one such paper was in fact given at ICCF10 by an experienced team.[3] This work must be taken very seriously now—the researchers at ICCF10 presented a technique that looks very promising for reducing the radioactivity of nuclear waste. The biological transmutation phenomenon has profound implications for LENR theorists, most all of whom have preferred to ignore it. Dr. Ed Storms, to his credit, embraces it objectively. He wrote in December 2001 in his "Cold Fusion: An Objective Assessment": "Transmutation is claimed to occur in living systems where the process becomes especially difficult to believe or understand. Indeed, people have advised me not to discuss this subject, as if the potential reader would be too immature to handle the intellectual conflict this discussion might cause." The research in biotransmutation suggests that biological systems have discovered *something in nature* which they make use of to carry out nuclear changes; and using that "something" most definitely does *not* require the loading of or presence of Pd or Ni cathodes or any metallic lattice within a living system, which—apart from prosthetic devices in people—do not exist. Could it be that our basic atomic and nuclear physics models are flawed at their foundations? Could it be, perhaps, that those many researchers—in medicine and in biology, far removed from the LENR field—who have found other kinds of anomalous behavior in biological systems, are in truth observing the signal of a pervasive medium that is ignored not only in medical and biology texts, but in physics as well? Indeed, that seems to me to be the essence of what is befuddling us all—we are ignoring *most of the physical universe* in attempting to explain LENR with incomplete and obsolete physics. And, friends, that will just not work. It may "work" for academic speculators about "dark matter" and "dark energy," who endlessly bend their theories to conform to the latest fashion and who have no ability or intention to discover world-changing technologies. But for researchers in LENR, ignoring what constitutes most of the universe may be nothing less than suicidal.

This has been but the tip of the iceberg of the "anomalous within the anomalous." In other words, this is clear evidence from the LENR field itself that what I have begun to call the "Mainstream Cold Fusion Hypothesis," the MCFH paradigm (see below), must be reconsidered. Not that that paradigm is completely unworkable in all systems examined to date. Folks like Peter Hagelstein, Scott and Talbot Chubb, and Akito Takahashi have made valiant efforts to refine it. I personally do not believe, however, that the current metal lattice-based theories cannot constitute a generalized explanation for all the phenomena even within LENR proper.

Ludwik Kowalski Shakes Up the Physics World!

Unknown to LENR researchers, a thoughtful physics professor at Montclaire State University in New Jersey, who attended ICCF10, had a significant change of mind on the matter of "cold fusion" about a year ago. He had set out then to learn the truth about the subject. He knows now that it is not "voodoo science." Now he is making waves with his provocative website devoted to cold fusion/LENR, in particular as it relates to what teachers of physics should say about the subject. Marvelous!

Check out http://blake.montclaire.edu/~kowalskil/cf.

Previously, Kowalski had bought onto the views of Dr. John Huizenga, after having read his anti-cold fusion book, *Cold Fusion: The Scientific Fiasco of the Century*. There is great irony here. Dr. Kowalski had been a respected colleague and co-worker of Dr. John Huizenga years ago. Huizenga later had become a prominent anti-cold fusion critic, who as Co-chair would drive the 1989 DOE ERAB Cold Fusion Panel in a negative direction, and Kowalski had been influenced by Huizenga's deadly book. Kowalski still does not fully accept the claims within the LENR field, he says—it is too new and astonishing to him. He wonders whether Huizenga knowingly set up what Kowalski now knows to be the "straw man" of the hot fusion physics model, in order to attack cold fusion. But after attending ICCF10 and being a vocal participant, Kowalski is impressed with what he has seen, and he has tried, so far unsuccessfully, to politic for a reconsideration of the field. In his ICCF10 presentation, he advocated various strategies to deal with neutrals and the negativists. He wondered why

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"hundreds of sophisticated research scientists have not developed (yet) a 100% reliable demonstration in thirteen years." Good question. He remarked, "Even a 70% repeatable demo would be useful." Though I did not agree with all the remarks of this newcomer, it is refreshing to encounter the voice of an outspoken, energetic, and well-placed "convert."

Wake Up Call to the U.S. Department of Energy

Conference Chair Professor Peter Hagelstein of MIT is not one to engage in any direct attempts to rock-the-boat at official levels on the matter of cold fusion, but the results of ICCF10 were so solid, in his view, that it prompted him to write on September 12 to U.S. Department of Energy Secretary Spencer Abraham (see text of letter in this issue, p. 45). The Hagelstein letter has already caused a stir at the highest levels of DOE, and though I remain pessimistic about its prospects for turning around the mostly hostile DOE bureaucracy, it is a matter of record that the letter has been received by DOE (via Federal Express delivery) and is under consideration there. The letter asks for something that is thoroughly reasonable, but this is also anathema to an immobile and opposed bureaucracy. In Hagelstein's words to Abraham: "I propose that you consider the possibility of convening a new review panel to provide an updated recommendation based on the initial tasking provided by Admiral Watkins [in 1989]." And why now rather than at any time in the past decade-and-a-half of struggle? From Hagelstein, "The conference was technically very strong, and has been considered by many to be the best of the ICCF series to date. The evidence for nuclear emissions from metal deuterides in a variety of experiments presented at this conference, and at previous conferences, is very strong. The experimental evidence in support of an excess heat effect that has accumulated over the years is very compelling, certainly strong enough that it should be of interest to DOE and the scientific community in general. . ."

Almost No Press Coverage!

Though there was an open invitation to press people prior to ICCF10, and I made an attempt to encourage specific members of the press core who might have had their eyes opened if they had come, only one outside journalist attended the meeting sessions and actually did some reporting. That honor goes to Sharon Begley of *The Wall Street Journal*. (A few others did arrive, but flitted in and then out as fast as fireflies.) Ms. Begley came at my urging and wrote a fine commentary in her September 5 "Science Journal" column, which I have described elsewhere in this issue (p. 45). Her piece was bannered appropriately: "Cold Fusion Isn't Dead, It's Just Withering from Scientific Neglect." In summary, she wrote: "What these claims need is critical scrutiny by skeptics. That is how science normally functions. But in Cold Fusion, it isn't. And that's the worst pathology of all." At another point she wrote, "But the real pathology is the breakdown of the normal channels of scientific communication, with no scientists outside the tight-knit cold fusion tribe bothering to scrutinize its claims."

The Military Research Presence at ICCF10

Though the press, by and large, has not been very good at covering LENR developments, some circles within the U.S. military have continued to focus some of their wide-ranging attention on LENR developments. The U.S. Navy has funded research in LENR and has published an official report on its work in the field, which advocates more research funding (see *IE* #44, pp. 54-55). And the U.S. DARPA (Defense Advanced Research Projects Agency) has in the past quietly funded work at both SRI International and at MIT (via Peter Hagelstein).

Here, very briefly, is a capsule of the military research presence at ICCF10:

- Physicist Dr. Lowell Wood of Lawrence Berkeley Laboratory and the Stanford, California conservative think tank, the Hoover Institution, attended not only ICCF10, but also ICCF7 (in Vancouver, B.C. in 1998) and ICCF8 (in Lerici, Italy in 2000). He missed ICCF9, in Beijing, 2002, presumably for reasons, in part, having to do with his high-level security clearance and travel to China. In my mind, and having spoken to Dr. Wood on an earlier occasion (at ICCF8), there is not the slightest doubt that Dr. Wood—who is better known for his association with the late Dr. Edward Teller (see obituary, p. 67) and his advocacy of anti-ballistic missile defense—understands *very well* that the bulk of the important results being reported at the ICCFs are real and incontrovertible. He accepts that a new class of nuclear-reactions has been discovered, with implications that could be rather profound. And, I would think, the possibility or probability of military implications cannot be far from his consideration. It is his style to orchestrate initiatives for the furtherance of LENR "behind the scenes," but so far there is no evidence that any of his advocacy has led to tangible policy changes. We shall see what the future may bring.
- Mechanical engineer Dr. Frank Gordon of the U.S. Navy attended ICCF10. He has been an advocate for the research within the U.S. Navy. From his ringing statement of endorsement in the U.S. Navy report on LENR, he would like to see official funding for the field.
- A research scientist with the U.S. Army attended ICCF10 on "his own ticket," but he would prefer to remain anonymous.
- Dr. David Nagel is now a Professor at George Washington University, but he formerly managed LENR efforts at the U.S. Naval Research Laboratory (NRL). He has attended all of the ICCFs, as far as I can recall. He continues to be an advocate for the field and provided a bold overview and endorsement of the field at an evening session of ICCF10 (August 25), that was open to the public. Nagel has advocated at least a $10 million official research budget for the LENR field.

If there is anything more ludicrous about the Establishment reaction to LENR, it is the obvious military implications of LENR discoveries that quite clearly are being discussed behind closed doors (and definitely still being attacked both openly and privately by members of the "Jasons" military advisory group, which includes negativists Steven Koonin and Richard Garwin), while in open sessions for over fifteen years the proofs from a huge new body of technical evidence is discussed, as though there were no possible military consequences of understanding:

A. How fissionable isotopes of uranium have apparently been created on electrochemical cell cathodes. The work of John Dash and Dan Chicea on the apparent production (enhancement) of ^{235}U from natural uranium foils via either glow discharge in hydrogen atmospheres or in electrolytic production is truly remarkable.[4] This high-Z transmutation, if it is validated, will show how "easy" and omnipresent the transmutation phenomenon is.

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B. How tritium, a key ingredient in thermonuclear weapons, has been produced in many different types of cold fusion cells.
C. How mild laser light can apparently stimulate nuclear phenomena at the surfaces of active electrolytic cathodes.
D. How from the Mitsubishi Heavy Industries transmutation work and other results, the possibility emerges that virtually any element or isotope might eventually be produced by very benign conditions, with virtually no energy input.

History will, I am sure, eventually record this preposterous upside-down world of reactions to these overarching discoveries in LENR. The now somnolent science journalists will then indulge in a feeding frenzy over "Who knew what when?" and "How could *they* (the culpable scientists) have been so stupid as not to recognize the reality of a vast new source of nuclear activity, which was potentially very dangerous?" Just a look in the mirror will tell them how this happened, though they surely will not acknowledge their own reflections.

A New Electronic Journal for LENR

As ICCF10 concluded on Friday morning, Peter Hagelstein announced the founding of a peer-reviewed electronic journal for the LENR field, *Condensed Matter Nuclear Science*. This is a title that had been approved by the ICCF organizing Committee at ICCF9 in Beijing (May 2002). The journal already has a website, http://cmns.mit.edu, on an MIT-run server. The editors of the new journal are, For North America: Peter Hagelstein, Michael McKubre, George Miley, and Ed Storms; For Europe: Jean-Paul Biberian and Francesco Scaramuzzi; For Asia: X.Z. Li and Akito Takahashi. Editorial correspondence may be sent to the editors at CMNSEditor@aol.com. Hagelstein remarked that he anticipated that the strict standards of unbiased, fair review would lead to an acceptance rate of 50% for submitted papers. He welcomes especially "focussed theory papers on new phenomena."

The Mainstream Cold Fusion/LENR Paradigm: Its Limitations

The astonishing results presented at ICCF10 have sharpened a fundamental issue that has been lurking in the background in the "cold fusion" field since its early days. We all know that our tortuous path began with the assertion by Martin Fleischmann and Stanley Pons (F&P) that evidence for previously unknown kinds of nuclear reactions and excess heat of large magnitude could be observed in certain electrochemical cells with heavywater-based electrolyte.[5] They wrote, ". . .the data on enthalpy generation would require rates for reactions (v) and (vi) in the range 10^{11} - 10^{14} atoms s^{-1}. It is evident that reactions (v) and (vi) are only a small part of the overall reaction scheme and that other nuclear processes must be involved." (Reaction (v) was $D + D \rightarrow T + H$ and reaction (vi) was $D + D \rightarrow {}^3He + n$.) They reiterated this in the discussion section of their controversial paper, "The most surprising feature of our results however, is that the reactions (v) and (vi) are only a small part of the overall reaction scheme and that the bulk of the energy release is due to an hitherto unknown nuclear process or processes (presumably due to clusters of deuterons)." Indeed, it was very reasonable for them to presume that a class of nuclear reactions might ultimately explain cold fusion—since some nuclear products had already been detected (tritium generation and low-level neutron emission, which were later confirmed in more exacting ways) and the magnitude of the excess energy was far too large to be explained by conventionally understood chemical reactions.

This set the stage for the battle that has now waged for fourteen-plus years, with the critics denying the existence of *any* evidence in support of the F&P nuclear reaction hypothesis—either from excess heat measurements or from measurements of nuclear products. From the results presented at ICCF10 and all previous ICCFs, the evidence for large magnitude excess heat production in the LENR field is overwhelming, as is the evidence for a variety of nuclear products and emissions. The critics are profoundly wrong. That leaves the hypothesis posed by F&P initially that the "bulk of the energy release is due to an hitherto unknown nuclear process or processes." Can that hypothesis be adequately defended, as so many in the LENR field maintain?

The first experimental indication that F&P's hypothesis might be correct came in early-1991, when Miles *et al.* found a correlation between the excess heat from F&P-type cells (or the lack of excess heat thereof in cases that were null) and the presence or absence of ^4He signature in the gas evolved from the F&P cells in their lab.[6] They reported this formally in the scientific literature in 1994.[7] But while these remarkable results were being readied for publication, several new directions or offshoots had emerged from and within the CF/LENR field. In the spring of 1991, Dr. Randell Mills *et al.* reported significant excess heat from ordinary water cells with nickel electrodes, an energy which they deemed to be coming *not* from nuclear reactions, but from a new form of catalyzed shrinkage reaction via a drastically remodeled form of the hydrogen atom and a re-write of quantum mechanics, which is now called by Mills "Classical Quantum Mechanics" (CQM).[8,9] These explanations (and even the claim of excess heat in ordinary water-based electrochemical cells) did not go over well either with the CF/LENR community or the hard-line Establishment critics of table-top anomalous physics. CF/LENR scientists, themselves outcasts from the Establishment, strangely enough have not paid much attention to Mills' experimental work. This is most unfortunate, because it is compendious and strongly supportive of excess heat but also of non-standard, highly anomalous, spectral anomalies from hydrogen systems. This stance can be explained because of the very strong resistance by CF/LENR theorists to exploring foundational flaws in Standard Quantum Mechanics (SQM). Mills' CQM work could shed considerable light on the problem of LENR—these are results that cannot and should not be logically separated from efforts to understand LENR results proper.

Randell Mills, for his part, wants nothing to do with the "cold fusion" field, in part because of the bad "PR" that cold fusion has acquired. But Mills, while accepting that his "shrunken" (sub-ground state) hydrogen atoms ("hydrinos") may well cause nuclear reactions due to their more charge-neutral presentation to other nuclei, does not believe that the excess heat being reported in LENR experiments is of nuclear origin—*i.e.* the direct result of nuclear reactions with a mass-deficit of Δm, with an energy equivalent output found by $E=\Delta mc^2$. This latter hypothesis within mainstream cold fusion we should designate for brevity the MCFH—the Mainstream Cold Fusion Hypothesis.

Though Mills' CQM theory may itself have significant flaws,

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it does have two characteristics that recommend it: A) It seems to have very significant *predictive power* to suggest what hydrogen systems are likely to evolve excess heat, and which ones may not (more such predictive ability than most CF/LENR concepts), and B) CQM is not beholden to the "mainstream cold fusion hypothesis" (MCFH)—*i.e.* at least it allows the possibility that many instances of excess heat are not of nuclear origin per se. In this latter "Point B" Mills is likely closer to the truth (but possibly for the wrong reasons!) than are champions of MCFH theories. One only has to examine the 100% repeatable excess energy work of Peter and Neal Graneau in water arc explosions and air arc phenomena (see References 21-26) to realize this. Neither the MCFH nor Mills is likely to be able to explain these phenomena.

In the early 1990s there also began to be increasing reports of heavy element transmutation phenomena in low-energy experiments; some of the most remarkable initial results came from John O'M. Bockris *et al.* at Texas A&M (see the Bockris story in Reference 10). I well recall the extreme resistance to accepting these heavy-element transmutation claims in the period 1992-1994, expressed to me by some prominent cold fusion theorists, such as the late Julian Schwinger and Talbot and Scott Chubb. Today, heavy element transmutations are in general very well accepted in the CF/LENR field. Some of the most remarkable and definitive results that support such transmutation phenomena have been published by a group at Mitsubishi Heavy Industries Advanced Technology Research Center.[11,12] Talbot Chubb, for his part, believes he can explain such transmutations via an extension of his earlier theoretical framework that predicts ^{4}He formation in or on metal lattices.[13] I believe that this proposal is grasping at straws and represents an *ad hoc* proposal to preserve loyalty to conventional SQM. Talbot admits that his theory in which a "many-body wavelike deuteron system overlaps with a localized cesium-133 atom" to produce praesodymium may be a stretch. He writes, "I know the above sounds fanciful. It requires that quantum mechanics obey previously unexplored rules when applied to a many-body ion system bound within a multiplicity of shallow wells. These rules are not tested when a many body system is bound within a single potential well." Better that he should consider that SQM just cannot handle this powerful form of blatant "modern alchemy" in which no special electrical energy input or loading is evidently required. To me, the Mitsubishi work strongly suggests that there is something deeply wrong with our understanding of atomic and nuclear structure—*i.e.* SQM has a Big Problem.

Of the many CF/LENR papers that report excess heat as well as nuclear products, one stands out for showing a quantitative relationship between excess heat and nuclear products, *i.e.* rough obedience to the MCFH. This is work that was reported first in 2000 at ICCF8 by McKubre *et al.* at SRI International.[14] The group performed multiple tests of Dr. Les Case's "catalytic fusion" process, which employs heated palladium-coated carbon catalysts in deuterium gas atmosphere. The replication team cross-checked its results with two types of calorimetry and it published data which shows the increasing evolution of ^{4}He on multiple runs. Moreover, the group was able to correlate the quantity of helium produced at different times during each run with the excess energy produced. The regression lines for each form of calorimetry gave: Q=31±13 MeV/^{4}He atom (for the gradient calorimetry method) and Q=32±13 MeV/^{4}He atom (for the differential calorimetry method). The authors were careful to state: "Although these Q values include that of reaction [1] within their assigned uncertainties, the mean values for the ^{4}He presented directly to the gas phase for analysis is only ~75% of that predicted by Equation [1]." Equation [1] referred to is, of course, $D + D \rightarrow {}^4He + 23.8$ MeV (lattice), which corresponds to the hot plasma fusion D + D fusion reaction yielding a 23.8 MeV γ ray. Error bars aside, it is very tempting to suggest that this data is highly suggestive of a kind of net D + D fusion reaction that produces ^{4}He, but we must be cautious because: A) There isn't highly accurate measurement of the energy-per-atom release and B) Because of the possibility that other nuclear change phenomena connected with alterative fundamental physics theories might eventually be found to yield the same net reaction results.

It is most disappointing that there has not developed more firm evidence to support the MCFH. There is a dearth of other results like the SRI data. There are also prominent experiments within CF/LENR that cast doubt on the rigor of the MCFH—but not, I repeat, against the basic validity of the large-magnitude excess heat and nuclear changes and emissions.

My colleague Dr. Scott Chubb (the technical chairman of ICCF10) with whom I have an "agreement to agree to disagree" on matters of the acceptable breadth of the CF/LENR field, was properly frank and up-front in one of his ICCF10 abstracts[15] when he wrote: ". . .it is not at all clear that key features associated with many LENR processes have been identified. For this reason, it is plausible that most ideas associated with LENR's must be viewed as speculative." Indeed, the central problem exhibited by CF/LENR theorists—as heroic as they have been—is that they have failed to comprehend or admit two glaring facts: A) The breadth of the CF/LENR evidence proper is so stupendous and Alice-in-Wonderland that there appears little hope for SQM/relativity to deal with it and B) LENR theorists are ignoring—*deliberately so*—excess energy and other phenomena that are right at their doorstep.

A New Path for LENR?

My view is that we should adopt this position: More progress will occur in LENR if it is understood by researchers that the field can't remain contained within its usually defined borders. The discovery of fission in the late 1930s offers a useful analogy: Nuclear fission was serendipitously discovered during an attempt to make transuranic elements via neutron bombardment of natural uranium. The investigators did not realize initially that it was fission fragments, not transuranic elements, that were being observed. When they realized that nuclear fission was occurring with neutron production as well, the path to a new chain-reaction energy source opened. The discovery of fission contains a stark warning to the LENR field today, which I had no way of realizing when I wrote the following passages in *Fire from Ice: Searching for the Truth Behind the Cold Fusion Furor* (Wiley & Sons, 1991):

> Physicist Emilio Segre, who died at age 84 less than one month after the March 1989 announcement in Utah, the previous December had recounted the discovery of nuclear fission—on its 50th anniversary—before a meeting of the American Physical Society.* (*Emilio

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Segre, "The Discovery of Nuclear Fission," *Physics Today*, July 1989: 38-43.) Segre had worked with Enrico Fermi in Rome in 1934 on experiments that bombarded uranium with neutrons to attempt to produce what they thought would be the first artificial element beyond uranium, element 93—one that by prediction would be similar chemically to rhenium. But this strong expectation of a result prevented the discovery of fission for five years before Hahn and Strassman in Germany ultimately recognized it. They too would make the same mistake by expecting what the Fermi group had likewise anticipated. Segre also recalled other lost opportunities: how another scientist had suggested the possibility of fission happening in their work, but whose writing was ignored; and Swiss researchers who may have seen the fission fragment evidence but who instead thought something was wrong with their detector. But the biggest problem was the expectation of seeing an element heavier than uranium, and not paying attention to the possibility of lower mass atoms that turned out to be the telltale fission fragments.

Segre said of writings by Hahn and Meitner on the road to the discovery of fission, "Their early papers are a mixture of error and truth as complicated as the mixture of fission products resulting from the bombardments. Such confusion was to remain for a long time a characteristic of much of the work on uranium." Segre recalled, "My own feeling at the time was that there was a mystery in uranium." In a remarkable statement printed in the historic December 22, 1938, paper in *Naturwissenschaften* announcing the fission discovery, Hahn and Strassman wrote, *"As 'nuclear chemists' working very close to the field of physics, we cannot yet bring ourselves to such a drastic step, which goes against all previous experiences in nuclear physics."* When the great physicist Niels Bohr heard of the new insights on fission, he was reported to have exclaimed, "Oh what idiots we have all been! Oh but this is wonderful! This is just as it must be!" As Segre concluded in his talk, "Above all, it seems to me that the human mind sees only what it expects." Scientists who go far afield to explore puzzles and anomalies often bump into obstacles, but every once in a while they run into a remarkable phenomenon waiting to be discovered. It was just so with fission; might it be true also with cold fusion?

Concluding Summary, and a Concern

During the past almost fifteen years since the announcements in Utah by Drs. Fleischmann and Pons, and separately Jones, indisputable experimental evidence has built up for substantial excess heat (far beyond ordinary chemical energy) and also for low-energy nuclear reaction phenomena in specialized heavy hydrogen and ordinary hydrogen-containing systems. The primary theorists in the field that, indeed, should properly be designated LENR have generally assumed that their group of excess heat phenomena is fundamentally commensurate with nuclear ash (such as helium), whether already identified or presumed to be present but not yet found. That was an excellent initial hypothesis. However, the *strictly commensurate nuclear ash hypothesis* has not been proved, and appears to be approximately correct in only a few experiments. During this same period, compelling evidence—although not as *broadly* verified as data from cold fusion/LENR—has also emerged for other microphysical sources of energy that were previously unexpected by accepted physics. The exemplar of this has been the "hydrino" physics work of Dr. Randell Mills and his colleagues at BlackLight Power Corporation, which was a radical outgrowth from the cold fusion field that emerged publicly in May 1991.[16] Even more far-reaching is the work in vacuum energy extraction pioneered by Dr. Paulo and Alexandra Correa, which first became public in 1996.[17] This vacuum energy experimentation began in the early 1980s and has been reduced to prototype technological devices, such as the patented PAGD™ (pulsed abnormal glow discharge) electric power generator, as well as many published experiments that can be performed in table-top fashion to verify the Correa "Aetherometry" (*non-luminiferous* or *non-electromagnetic* aether measurement science).[18] Furthermore, there also appear to be other experimentally verified excess energy processes, some more substantially confirmed than others, which have not generally been categorized into one of these three research areas.

In an era when mainstream science and its media is all agog about "dark matter" and "dark energy" composing the vast bulk of the universe, there is a great need to reconcile, if possible, the significant bodies of evidence from these three major experimental and theoretical streams: "cold fusion"/LENR, hydrino physics, and Aetherometry. I predict that if scientific knowledge continues to be constrained artificially by blinders to experimental results and theoretical formulations in these inseparable fields, the road to success in any one of these fields standing by itself, *i.e.* acceptance by means of coherent scientific persuasion, as well as commercially available technologies, will be very much longer than it needs to be. In particular, the LENR field, which has moved forward experimentally in a mostly empirical fashion, may continue to be held back from the more rapid progress for which its advocates hope.

Onward to ICCF11. . .

We come full circle to prospects for the next ICCF. Since the first ICCF in 1990, there has been a rotation of the conferences from North America to Europe to Asia. Because ICCF9 was held in Beijing and ICCF10 in the U.S., the informal organizing committee has selected Dr. Jean-Paul Biberian of France to organize ICCF11. It will be held in Marseilles, France in late September 2004 or sometime in October 2004. We'll let readers know the exact date when it has been set. ICCF10 had attendees from: Australia, Bahamas, Canada, China, England, France, India, Israel, Italy, Japan, Nigeria, Norway, Russia, Ukraine, and the U.S. I expect that the diversity of international participation will be even greater for ICCF11 than for ICCF10. Be there!

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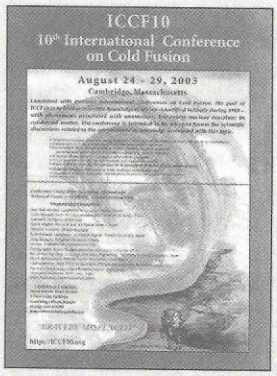

The past few issues of *Infinite Energy* have featured a page-size version of the colorful official announcement poster for the historic ICCF10 conference. Larger versions of this color poster may be downloaded from www.lenr-canr.org, but some readers may wish to own the real thing—as historic memorabilia. The poster is printed on heavy poster stock, and would make a delightful art object if framed—or perhaps a welcome surprise addition for your favorite local physics or chemistry department bulletin board? Several hundred of these posters still exist and are now being offered for sale. They will be sent in secure mailing tubes to those who order them. Net proceeds will be assigned by New Energy Foundation toward offsetting expenses for ICCF11:

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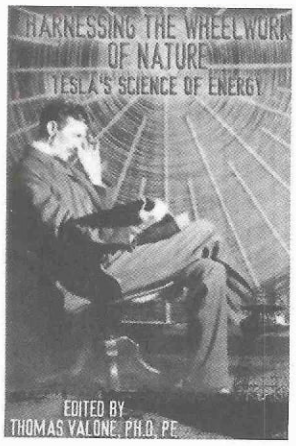

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The DEMON Trapped

Eugene F. Mallove

I feel especially lucky (or perhaps unlucky!) for having been present—and *aware and observant*—at the birth of more than one scientific revolution. For me, entrance to discoveries in New Energy began on a single day, March 23, 1989, with the announcement of "cold fusion" by Drs. Fleischmann and Pons at the University of Utah. This low-energy nuclear reactions (LENR)—modern alchemy—revolution is now in full swing. Later, I would be introduced gradually (from 1996 to 2000) to a revolution in our conception of the vacuum state—"vacuum energy"—through the experimental work of Dr. Paulo and Alexandra Correa, though others on the vacuum energy frontier had earlier peaked my curiosity. The Correas were the first to show me concrete physical evidence of vacuum energy, not merely theoretical speculation. But midway through these two upheavals, through my colleague Kenneth Rauen at New Energy Research Laboratory, I became aware of a third emerging scientific revolution—the shattering of our conception of the Second Law of Thermodynamics, one of the greatest, supposedly most impregnable bastions within physical theory.

This is a brief history of how it came about that you are able to read Ken Rauen's historic article, "The Proell Effect: A Macroscopic Maxwell's Demon," which *Infinite Energy* is very proud to present. When in May 2000 Ken had shown me the initial data from a thermodynamics experiment, which he had conducted in our laboratory in Bow, New Hampshire using relatively simple apparatus, I was "blown away." Not believing that such a test would likely yield positive results, I nonetheless had authorized this initial check of a gas-kinetic phenomenon that had been *predicted* years earlier—but *never tested*—by former Standard Oil Company engineer Wayne Proell of New Mexico. In his three heavy texts, Proell authored many heretical Second Law-violating propositions in thermodynamics, which he had documented (but had never tested in the lab). [See especially *The Thermodynamic Theory and Engineering Design of Supercarnot Heat Engines* (Cloud Hill Press, 1984), which can be ordered from Proell: 763 Dora Celeste Drive, Las Vegas, NM 87701.] We happened to have Wayne's books in our library, because we like to keep current on the frontiers of heretical physics. That bright day when Ken obtained his first experimental results on the "Proell Effect" for me began the shattering of yet another one of the grand illusions of "established science."

Initially I thought that it was possible that some kind of mistake in experimental design had been made, but there was no mistake. The experiment has been repeated hundreds of times with all manner of control experiments. I am certain that the Proell cooling effect documented in Ken's article is real. Anyone duplicating this experiment will immediately and repeatedly observe the effect—and we hope that others do confirm it, though the experiment itself is so well-documented and bulletproof, there is not a great need for widespread duplication. This is not like LENR, where the very theory underlying the effect is not known. In this case, the theory behind what causes the Proell Effect—it should probably now be termed the Proell-Rauen Effect—is completely known. It had just been overlooked. It is buried, hiding, and wasted, as Ken discusses, inside every Stirling engine! Dean Kamen and other Stirling developers take note.

However, to be very precise, the *implications* of the Proell-Rauen Effect experiment will no doubt be debated endlessly and with passion—*heatedly*, pardon the pun. We welcome such debate, if it focuses on the experimental evidence and the extensions of that evidence into analyzable thermodynamic cycles. Ken and I remain convinced that this astonishing Proell Effect (which leaves one breathless when one first sees it), embodied in appropriate technological designs, will indeed lead someone, somewhere—if not via Ken's own hands and blood and sweat—eventually to the infamous "Perpetual Motion Machine of the Second Kind." This is a device that can extract the kinetic energy of molecular motion from the environment and turn it into macroscopic technological work—without a lower-temperature reservoir into which to dump waste heat. In other words, a nearly perfect free energy device. Such a device would not even carry the baggage of the nuclear-associated directions that are implicit in working with LENR reactions—such as the generation of tritium and even the production of fissionable isotopes such as uranium-235. Please understand: I am in favor of developing *all* forms of New Energy—LENR (and/or hydrino), vacuum energy, and Second Law violations or extensions. All three horses will win, as I have written. They will each have their proper place in the coming New Energy Age.

It is not clear what the future will hold for the Proell-Rauen effect. The *implications* may not lead to the Promised Land of free energy. But at a bare minimum, I believe that every basic thermodynamics text on Earth should be revised—and quickly—to include this additional, previously unrecognized non-homogeneous *constant volume (isometric) process*. But a greater scientific and technological revolution might well ensue from the publication of this information in *Infinite Energy*. With the help of an outside investor from Europe, who later was devastated by reversals in the aftermath of 9/11, Ken and I tried to push forward with several laboratory prototype designs now held under the corporate umbrella, Cool Engines, Inc. The technological difficulties of making super-Carnot engines and PMM2s are daunting, however, as we have found—but Ken Rauen believes he knows the path forward, and he now experiments on his own time, without financial support. Incidentally, New Energy Foundation, Inc. is barred from funding such work, since one of its board members is a shareholder in Cool Engines, Inc.

I should mention, as does Ken in his article, that the manuscript for his article was first submitted to a mainstream journal known for accepting papers with frontier scientific information. It was rejected *without peer review* with the editor's off-hand remark that "favorable reviews would not be received from enough referees." This shows that even so-called frontier scientists can have their own quota of prejudice and obstinacy. In fact, there is a greater story that could be told about the difficult circumstances in the months preceding Ken's confirmation of the Proell-Effect at New Energy Laboratory. Several of Ken's associates opposed research on *macroscopic* Maxwell Demon phenomena, but none of them ever came to learn about the Proell Effect. They may or may not now realize their then incomplete understandings. What is most important now, however, is that we move forward to see where this remarkable new discovery will lead.

Can lightning strike a person three times? Yes! And I'm still among the living—I think. I admit that I have to pinch myself to realize how lucky I have been to be near Ground Zero three times. Chalk it up to a "prepared mind." ❐❐❐

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The Proell Effect: A Macroscopic Maxwell's Demon

Kenneth M. Rauen*

Background

Since the early days of the Industrial Revolution and the advent of the steam engine, scientists and engineers have developed a clear but incomplete understanding of the nature of heat and its conversion into work. The Second Law of Thermodynamics is the culmination of this understanding regarding the interrelationship of heat and work.

The Second Law of Thermodynamics is often stated as: "Heat flows spontaneously from a hotter to a colder object but not vice versa."[1] It is most succinctly stated as, "When an isolated system undergoes change, its change in entropy will be zero or greater than zero."[2-5]

One interpretation of the Second Law is the Kelvin-Planck Statement: "It is impossible to construct an engine that, operating continuously, will produce no effect other than the extraction of heat from a single reservoir and the performance of an equivalent amount of work."[6]

Another is the Klausius Statement: "It is impossible to construct a device that, operating continuously, will produce no effect other than the transfer of heat from a cooler body to a hotter body."[7]

In the late 1800s, James Clerk Maxwell was asked to comment upon the collective knowledge of thermodynamics at that time. His response accepted what was presented him, with one exception. That exception was voiced as a thought experiment that became known as "Maxwell's Demon." He proposed that thermal energy could separate, given conditions that would support this separation, without the addition of energy to do it. An intelligent being[8] of super-human capabilities of presence in space and time would operate a small, massless and frictionless trap door in a wall separating some air in an otherwise sealed chamber. Initially, that air would be at the same temperature and pressure on both sides of the partition. The being would open and close the door in response to approaches by atoms and molecules in the air. The being would open the door if a particle on one side were fast, allowing it to pass to the other side; a slow particle from that side would be reflected by the closed door. On the other side, the door would only be opened for slow particles, leaving fast particles on that side. The eventual result would be fast particles on one side and slow particles on the other. By the Kinetic Theory of Heat proposed in the late 1800s, it would mean a separation of heat into hot and cold zones without the expenditure of energy to do the separation.

Maxwell's Demon has remained an intellectual curiosity, but mainstream science and engineering have rejected this concept as false; Maxwell's thought experiment has been regarded as a violation of the Second Law. To date, no one has demonstrated a Maxwell's Demon—at least not publicly, so the persistence of this paradox has not bothered the scientific and engineering communities.

Theory

The science of thermodynamics is not complete. Some fundamental knowledge has been missing. A new understanding of the behavior of a confined gas that undergoes a temperature change in an isometric (constant volume, or "isovolumetric," as the author suggests) process has bearing on the Second Law.

Classical thermodynamics analyzes the constant volume process simply, succinctly, and solely as

$$Q = m\, C_v\, \Delta T = \Delta U, \qquad (1)$$

where Q is heat, m is the mass of the confined gas, C_v is the specific heat capacity at constant volume, ΔT is the temperature change experienced by the gas, and ΔU is the change in internal energy of the gas. This is for a homogeneous mass and is the only analysis presented by classical thermodynamics. The author is not aware of any other treatment of the constant volume process. See Figure 1 for a graphic presentation of the classical understanding. Analyses of the Stirling cycle, the only common application of the constant volume process in an engine or heat pump cycle, ignore what happens in the constant volume processes. Such cycle analyses use ideal gases and thus claim that its two processes cancel each other completely, since the energy changes are of opposite directions, and the ΔU of each is the same magnitude since U is only a function of T for an ideal gas and the two processes operate over the same temperatures. The details of what transpires in each isovolumetric process with displacement and regeneration are not presented.[9,10]

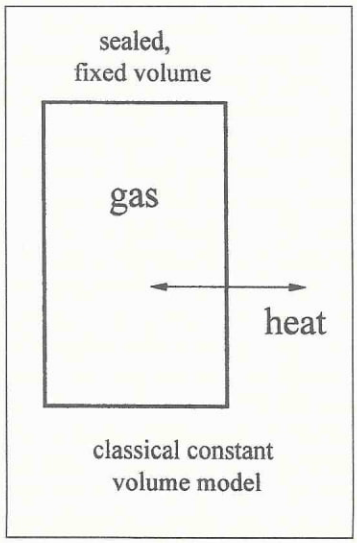

Figure 1. The classical constant volume model.

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Wayne Proell[11] was the first person, as far as can be determined, to describe in detail what goes on with gases in a constant volume process which is non-homogeneous, where the volume is separated by a displacer into two different temperature zones that are connected via a regenerative heat exchanger. The author acknowledges Wayne Proell's astute observations by calling the detailed behavior in a constant volume process with displacement and regeneration "the Proell effect." The Proell effect is unrecognized by classical thermodynamics, though it is consistent with classical thermodynamics. It is not seen in the Stirling cycle, because the two constant volume processes in the Stirling cycle are symmetrical, cancel each other, and thus have no net Proell effect on the cycle.

In a non-homogeneous constant volume process with displacement and regeneration (see Figures 2 and 3), the change in volume, ΔV, of an ideal gas discrete element of tiny volume displaced through a regenerator with a ΔT across the regenerator, will change in proportion to that ΔT in accordance with the Ideal Gas Law,

$$PV = nRT, \tag{2}$$

where P is pressure, V is volume, n is the number of moles of gas, R is the gas constant providing engineering unit conversion, and T is absolute temperature. Because of constant volume conditions, the localized ΔV discrete volume element in the porous regenerator must be compensated by an equal and opposite ΔV in the remainder of the gas not in the regenerator. *The corresponding pressure-volume work, W, involved with all localized expansions and compressions, transfers unexpected thermal energy between the regenerator and the gas of the hot and cold sides of the constant volume. Q is converted to W, which is immediately dissipated as Q in another location at a different T.* When a gas is cooled through a regenerator, it compresses, causing compensatory expansion of the gas not in the regenerator, which causes extra cooling of the gas, called self-refrigeration (SR). When a gas is heated through a regenerator, it expands, causing compensatory compression of the gas not in the regenerator, which causes extra heating of the gas, called self-heating (SH). These energy transfers are the essence of the Proell effect. See Figures 2 and 3 for graphic depictions of the processes.

The environment of the regenerator calls for the exchange of Q with the gas at its specific heat capacity at constant pressure, C_P. Intimate contact of the gas and the regenerator material insures constant temperature between the two media at any one location. Since the small parcel of gas undergoes a ΔT via displacement along the regenerator and therefore undergoes a ΔV, the associated compression or expansion W must come from or go to the regenerator, as the gas can only source or sink energy from its ΔU.

$$\Delta U + W = m\, C_P\, \Delta T = \Delta H, \tag{3}$$

where C_P is the heat capacity at constant pressure and ΔH is the change in enthalpy. $\Delta U + W$ implies C_P for the energy transformations inside the regenerator, and not as C_v, predicted by simplistic, classical analyses. This is merely an oversight, a lack of attention to detail. *Its implications are profound.*

The gas outside the regenerator can be in adiabatic hot and cold zones, as analyzed in this presentation. Isothermal conditions have the same anomalous energy flows, but do not exhibit the anomalous temperatures of adiabatic conditions. Adiabatic compression or expansion calls for C_v, as

$$W = m\, C_v\, \Delta T.^{12} \tag{4}$$

W is a transient form of energy. It must be stored or dissipated. It can be stored as kinetic energy, $mv^2/2$, or as potential energy, mgh, for example. It can also be dissipated as Q. Regardless of the pathway, W generated must be balanced according to the First Law of Thermodynamics by W absorbed. For example, W generated in the regenerator by constant volume heating must be compensated by W absorbed as Q in the gas in the bulk-volume, adiabatic zones outside the regenerator,

$$W_{gen} = W_{abs}. \tag{5}$$

Sign convention is ignored since absolute values are all that are important in this presentation, and the temperature changes in the following equations could be misunderstood. By the addition of W to ΔU, the total energy exchange becomes

$$m\, C_P\, \Delta T_{regen} = m\, C_v\, \Delta T_{bulk}, \tag{6}$$

which rearranges to

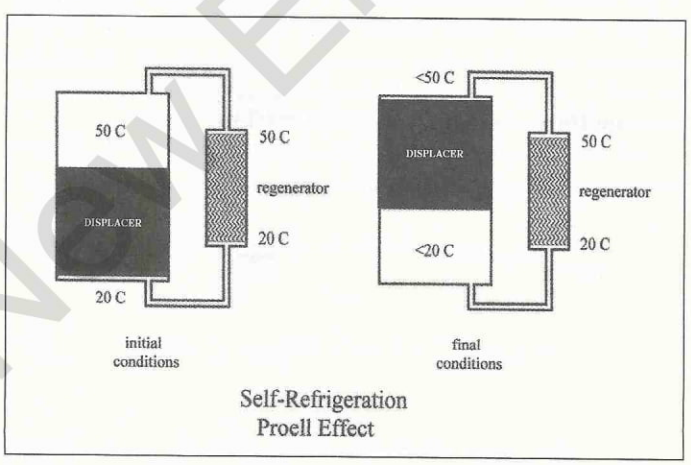

Figure 2. The self-refrigeration Proell effect.

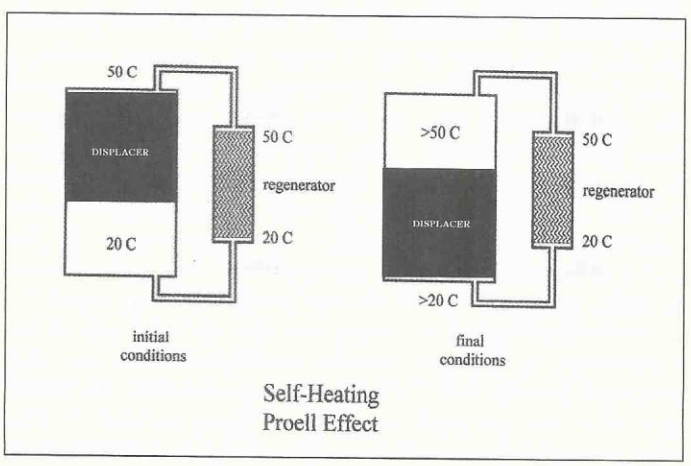

Figure 3. The self-heating Proell effect.

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$$\Delta T_{bulk} / \Delta T_{regen} = C_P / C_v = \gamma. \quad (7)$$

The W exchanged in a constant volume process with displacement and regeneration is in addition to the classical analysis of simple heat exchange at C_v with the heat exchanger. As an example of isovolumetric cooling, heat, as internal energy of the gas, is given to the regenerator. The resultant compression work is also absorbed by the regenerator as additional heat, making the total heat absorbed in the regenerator proportional to C_P. The compression work came from the expansion work in the bulk volumes outside the regenerator, which came from the remainder of the gas at C_v outside the regenerator. This is manifest under adiabatic conditions in the bulk sub-volumes of the system constant volume as temperature changes beyond the temperatures of the regenerator. When heat is allowed to flow in and out of those bulk sub-volumes under isothermal conditions, that heat is the heat sourced or sinked by the regenerator corresponding to the W energy.

The extra ΔT in adiabatic conditions is either SR (self-refrigeration) or SH (self-heating):

$$\Delta T_{SR} = \Delta T_{bulk} - \Delta T_{regen} \quad (8)$$

when the bulk volume and regenerator ΔTs are negative, and

$$\Delta T_{SH} = \Delta T_{bulk} - \Delta T_{regen} \quad (9)$$

when the bulk volume and regenerator ΔTs are positive.

The SR or SH energies are capable of being $(\gamma - 1)$ times the ΔU of the gas in the process. This is a potentially large energy transition, which could be used in a practical application. It is comparable to the proportion of work that can be derived from a heat input to boil water under high pressure.

These anomalous energy flows constitute a Maxwell's Demon on a macroscopic level. Thermal energy is transferred "uphill" from one location to another with no energy input under reversible conditions, but the transfer requires a perturbation of the system in order to occur. The displacement of a gas under reversible,[13] constant volume conditions has no work. Work is defined as force times distance. Force is zero, since there is no friction of the displacer and there is no pressure differential across the displacer. The heat separations that occur in the Proell effect are *in addition* to the pre-existing temperature difference between the hot and cold gas zones outside the regenerator and the temperature difference across the regenerator. Half of one Proell effect process, say the heat transfer on the cold side in a cooling stroke, is what constitutes a Maxwell's Demon, as heat is lifted from the cold side into the regenerator over a range of temperatures that are all greater than the resultant gas temperature in the cold side. The same is true for a heating process on the hot side, as heat is likewise lifted with no energy input under reversible conditions. (We mean "no energy input" in the sense of an ideal, reversible perturbation—but in a practical implementation it will be "in the limit, no energy input.")

If constant volume cooling starts with the cold side of the regenerator in dynamic thermal equilibrium with the cold side bulk volume and the ambient environment, the result will be a cold side bulk gas T that is *below ambient T*. This goes strongly against what would have been expected from common intuition. This internal heat sink may be used to advantage. Heat pumps and heat engines that apply the Proell effect have been designed by the author, and patents have been applied for by a corporation, Cool Engines, Inc.

By the most strict definition of the Second Law, the Proell effect is in conformance with it; the net isolated energy system entropy change is zero or greater than zero. The Second Law may be mathematically reduced to

$$\Delta S_{net} \geq 0, \quad (10)$$

where S is entropy. See Addenda One and Two.

For comparison, the same analysis can be applied to Maxwell's traditional thought experiment. What is found is that the isolated system entropy change, assuming the being doing the sorting is adding no energy to the system, is zero! See Addendum Three. This is contrary to the assumed entropy decrease of creating a system with two masses of different temperature from one initial mass at one temperature, as the system is more ordered than it was to begin with. Maxwell's Demon is assumed to be a violation of the Second Law, because the physical principle upon which the Second Law is based is the observation that heat spontaneously flows from high temperature to low temperature to establish thermal equilibrium and does not spontaneously exhibit thermal separations.

The Proell effect has practical considerations that limit its application.

When displacement occurs from one thermal zone to the other, the SR or SH is shared equally between the hot and cold sides. This reduces the maximum temperature excursions beyond the regenerator temperature extremes that may be achieved in one stroke. ΔT_{SR} and ΔT_{SH} are reduced to half of the full theoretical value previously identified with complete displacement. Compensatory work in the bulk volumes of the gas occur in both the hot and the cold sides, for both the heating and the cooling strokes, and throughout each stroke. Summed throughout an entire stroke, the hot and cold sides source or sink the same amount of W. As an increment of gas passing through the regenerator heats up, for instance, its V increases in direct proportion to the T increase by the Ideal Gas Law,

$$dV_{increment} = (nR/P_{increment})\, dT_{regenerator}, \quad (11)$$

where P is variable and incremental because the overall constant volume process will see a P increase as the entire mass of gas is heated from low to high-T in a fixed total V. As P increases over the entire constant volume stroke, the incremental V of gas passing through the regenerator decreases, keeping the incremental W transferred the same.

Full displacement results in half of the Q_{SH} or Q_{SR} manifesting on one side of the displacer,

$$Q_{SHcoldside} = 0.5\ m\ C_v\ \Delta T_{regen}\ (\gamma - 1), \quad (12)$$

and

$$Q_{SHhotside} = 0.5\ m\ C_v\ \Delta T_{regen}\ (\gamma - 1), \quad (13)$$

and

$$Q_{SRcoldside} = 0.5\ m\ C_v\ \Delta T_{regen}\ (\gamma - 1), \quad (14)$$

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and

$$Q_{SRhotside} = 0.5\ m\ C_v\ \Delta T_{regen}\ (\gamma - 1). \qquad (15)$$

$Q_{SHcoldside}$ and $Q_{SRhotside}$ are deposited in the regenerator, on the side that received the gas, stored as a change in the thermal profile across the regenerator. It is recognized that the thermal profile in the regenerator will be altered by the entrance of gas with temperatures altered by SR or SH. This decreases ΔT_{regen}, creating a significant engineering challenge to maintain a large ΔT_{regen}.

This effect upon the regenerator temperature differential manifests in practical Stirling cycle engines, though it has not been recognized. The inability of practical Stirling engines and heat pumps to approach the Carnot efficiency closely has likely been attributed to the smearing of the cycle processes by sinusoidal piston and displacer motion; this undoubtedly is a factor, but the Proell effect contributes another significant loss mechanism. A discontinuity is created in the thermal gradient of the regenerator, with the hot side T depressed and the cold side T elevated. This creates entropy-increasing irreversibilities in subsequent heat flows through the regenerator that decrease the manifestation of the separation of heat according to the Proell effect.

Seeing *a net Proell effect in a useful device* requires exceptionally good engineering to make it show up well. Thermal conduction and convection losses also work against a useful application of the Proell effect.

Partial displacement shifts the portions of the Q_{SH} or Q_{SR} manifested on each side. Some gas can remain undisplaced, either on one side or on both sides of the displacer.

If only one side has an undisplaced mass of gas, called a minimum volume by the author, that side is the dominant side, where more than half of Q_{SH} or Q_{SR} will manifest. For a given constant V, less gas will traverse the regenerator and thus less energy will be transferred. For a given mass displaced, partial displacement calls for a larger constant V, and the amount of the Proell effect energy transferred to or from the larger bulk V of gas is increased.

The increased compliance of the larger gas sub-volume is what causes the compensatory W to preferentially interact with that mass and volume of gas. The smaller mass and volume on the other side of the regenerator is stiffer, and less able to source or sink the W, as V will change less for a given, applied P. The new formulae for Q_{SH} and Q_{SR} in processes with a minimum volume on one side of the displacer are,

$$Q_{SRcoldside} = (\text{minimum cold side mass fraction} + 0.5 \text{ hot side mass fraction}) \times (\text{mass transferred})\ C_v\ (\Delta T_{regen})\ (\gamma - 1), \qquad (16)$$

and

$$Q_{SRhotdside} = (0.5 \text{ hot side mass fraction})\ (\text{mass transferred})\ C_v\ (\Delta T_{regen})\ (\gamma - 1), \qquad (17)$$

and

$$Q_{SHhotside} = (\text{minimum hot side mass fraction} + 0.5 \text{ cold side mass fraction}) \times (\text{mass transferred})\ C_v\ (\Delta T_{regen})\ (\gamma - 1), \qquad (18)$$

and

$$Q_{SHcoldside} = (0.5 \text{ cold side mass fraction})\ (\text{mass transferred})\ C_v\ (\Delta T_{regen})\ (\gamma - 1), \qquad (19)$$

where mass transferred is the mass transferred through the regenerator.

The self-refrigeration and self-heating temperature changes in full displacement become,

$$\Delta T_{SRcoldside} = \Delta T_{SHcoldside} = 0.5\ (\Delta T_{regen})\ (\gamma - 1). \qquad (20)$$

The self-refrigeration and self-heating temperature changes in partial displacement with only one minimum V become,

$$\Delta T_{SRcoldside} = (\text{minimum cold side mass fraction} + 0.5 \text{ hot side mass fraction}) \times (\Delta T_{regen})\ (\gamma - 1), \qquad (21)$$

and

$$\Delta T_{SRhotside} = (0.5 \text{ hot side m fraction})\ (\Delta T_{regen})\ (\gamma - 1), \qquad (22)$$

and

$$\Delta T_{SHhotside} = (\text{minimum hot side mass fraction} + 0.5 \text{ cold side mass fraction}) \times (\Delta T_{regen})\ (\gamma - 1) \qquad (23)$$

and

$$\Delta T_{SHcoldside} = (0.5 \text{ cold side m fraction})\ (\Delta T_{regen})\ (\gamma - 1) \qquad (24)$$

More than half of the theoretical Proell effect can be captured, approaching the full theoretical value, when the majority of the gas confined to constant volume is on one side of the displacer, providing regenerator irreversibilities previously identified are minimized. The application of partial displacement of the Proell effect has been incorporated into new heat engine and heat pump cycles, which have patents pending.

The Proell effect is symmetrical and reciprocal, meaning its mere reversal (not to be confused with thermodynamic reversibility) will produce a null net result under reversible conditions if its regenerator is designed to minimize irreversibilities. Regenerator irreversibilities will promote more rapid conduction of heat from the hot side to the cold side, thus decreasing efficiencies or COPs.

Experimental Verification

New Energy Research Laboratory has confirmed the Proell effect. The initial tests were conducted in May 2000, when the laboratory was located in Bow, New Hampshire, and have been confirmed many times, and their significance confirmed with many control experiments.

A plastic cylinder enclosing a fixed volume of gas is heated electrically on one side of a displacer to create a temperature differential across the displacer. See Figures 4, 5, and 6. The displacer doubles as the regenerator, composed of steel wool contained in an open-ended plastic cylinder placed inside the constant volume outer cylinder. Packed plastic drinking straws and coffee stirrer straws have also been used as regenerator material. Displacer motion is controlled manually by magnetic

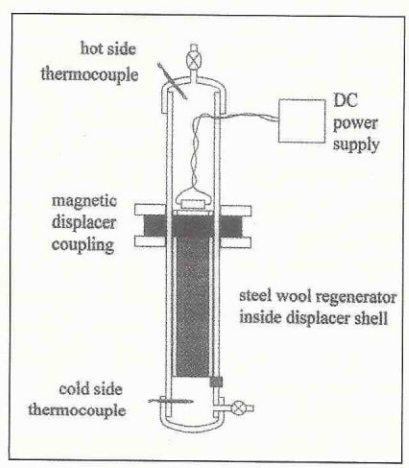

Figure 4. A cut-away view of the test apparatus.

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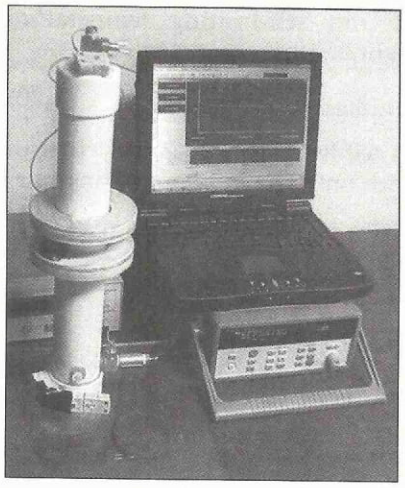

Figure 5. Photograph of the test apparatus.

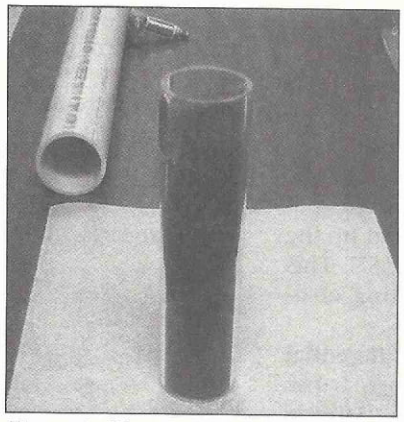

Figure 6. Photograph of the displacer prior to assembly. Note the acrylic cylinder which forms the displacer shell holds a bar magnet and the steel wool which composes the regenerator. The acrylic shell forms a slip fit inside the PVC tubing seen in Figure 5.

coupling between permanent magnets embedded in the displacer shell and magnets outside of the constant volume cylinder. Thermocouples monitor the temperatures in both cylinder ends, the hot and cold zones. The test apparatus is mounted vertically, with displacer motion in the vertical direction. Electrical resistance heating in the upper gas sub-volume provides the thermal differential across the regenerator before the test begins. Dynamic equilibrium of the apparatus with applied heat is achieved before the displacer is stroked from its equilibrium position, with the displaceable gas present predominantly on the hot side and with the displacer at its lowest gravitational potential. The displacer is then stroked upward to move the heated air through the regenerator to the cold side. After thermal stability is established again, the displacer is lowered to its starting position. The up stroke demonstrates SR and the down stroke demonstrates SH. Thermocouple temperatures are monitored by a computer-controlled datalogger, a Hewlett Packard HP 34970A, with BenchLink software running on a personal computer. The sample period was every 0.3 seconds. Various mechanical configurations of the test apparatus have been used, all demonstrating the effect, but with differing ΔT_{SR} and ΔT_{SH} in the cold zone. Only one is reported in this paper. Different gases have been used in some testers (air, nitrogen, argon, carbon dioxide), with valving on the hot and cold sides of the constant volume cylinder used for flushing and venting. The reported Proell effect temperatures are approximately 60% of theoretically predicted. A 40 gauge (0.001 inch diameter) type K thermocouple was used in the cold zone and a 30 gauge type J was used in the hot zone. Hot zone Proell effects were not monitored in this tester due to noisy T fluctuations caused by turbulence from the heater, so the slower response time of the 30 gauge thermocouple was not a limiting factor. Non-adiabatic conditions cause rapid readjustment of the thermocouple readings after the constant volume is displaced, so the 40 gauge sensor was useful for good detection of thermal changes.

Figures 7 through 13 are data from a series of tests for one test apparatus, done sequentially during one day over a period of about one hour. Hot side temperature and room temperature were recorded in addition to cold side temperature, but only the cold side thermocouple data is graphically presented here. Figure 7 displays the cold side temperature noise characteristics, without stroking the displacer.

In Figures 8 through 13, the displacer was stroked upward 10 seconds into the test and was stroked downward at the 15-second mark.

The displacer was stroked in static thermal equilibrium with the ambient environment, both with the hot side valve open and later closed. Figure 8 is the isobaric (valve open) condition and Figure 9 is the isometric (valve closed, constant volume) condition, respectively. Little above the noise (about 0.1˚C) was seen in either valve state; these are important control test results, to be discussed later.

The test apparatus was then heated to dynamic thermal equilibrium, establishing a thermal gradient across the regenerator, Δ21˚C for air as the gas inside the tester. With the hot side vent open to the atmosphere, establishing constant pressure conditions and preventing thermal disruption of the cold side thermocouple from not using the cold side vent, the displacer was stroked; approximately +/-0.15˚C was seen, mostly displaying a +0.1˚C rise. This is another important control experiment, to be discussed later. See Figure 10. Note that this several second trend (barely visible in this presentation of the data) only occurred on the cooling stroke (the up stroke) and not on the heating stroke (the down stroke). This is attributed to hot air bypassing the regenerator between the regenerator shell and the cylinder wall, and to breakthrough of heat through the regenerator. Convection currents take time to reach the cold side thermocouple.

The hot side valve was then closed, making the device constant volume, and the displacer was then stroked again.

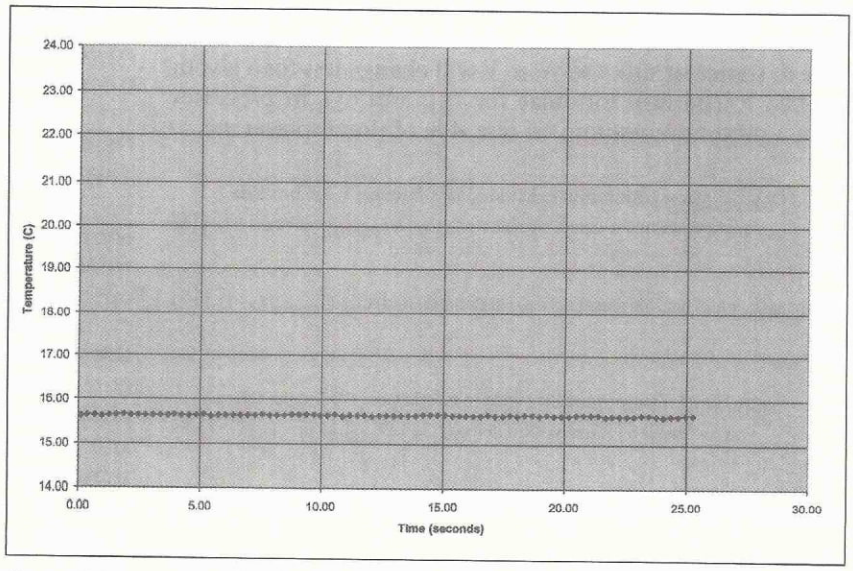

Figure 7. Temperature data for the system charged with air at thermal equilibrium and mechanical rest.

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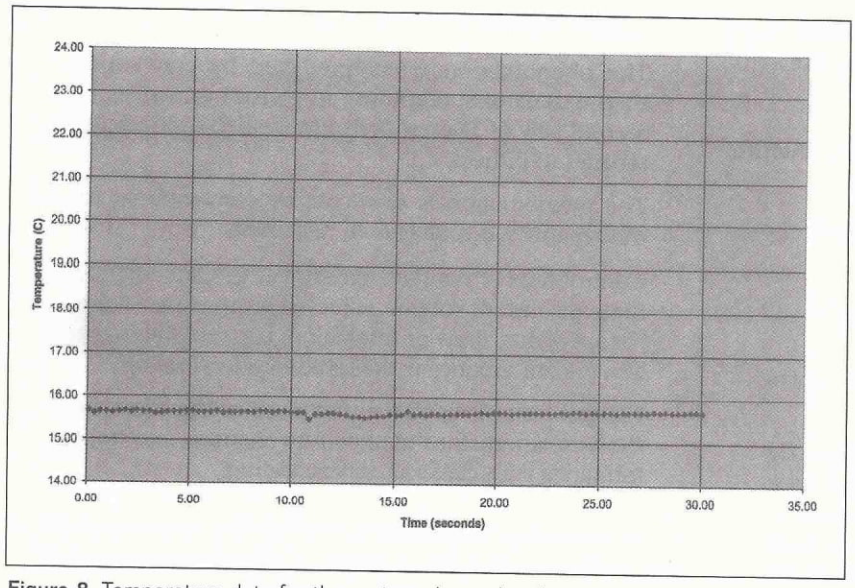

Figure 8. Temperature data for the system charged with air at thermal equilibrium with constant pressure conditions.

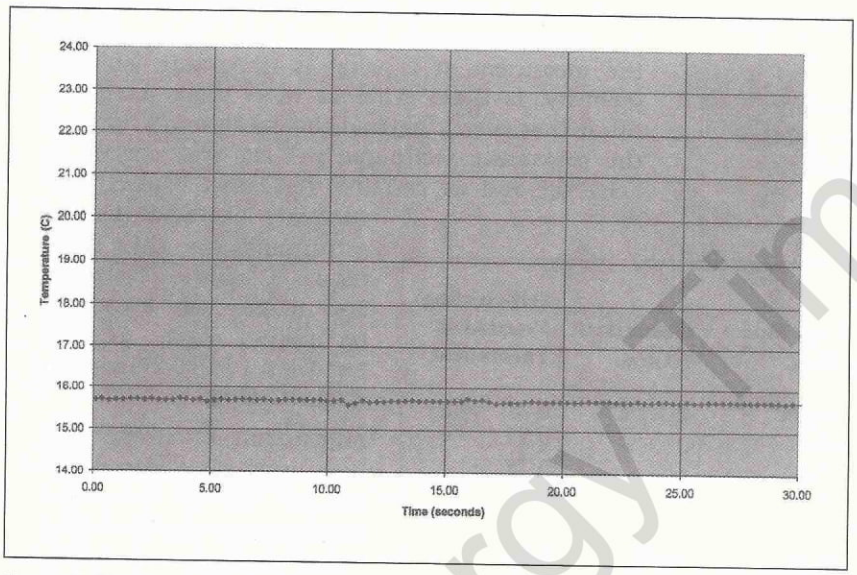

Figure 9. Temperature data for the system charged with air at thermal equilibrium with constant volume conditions.

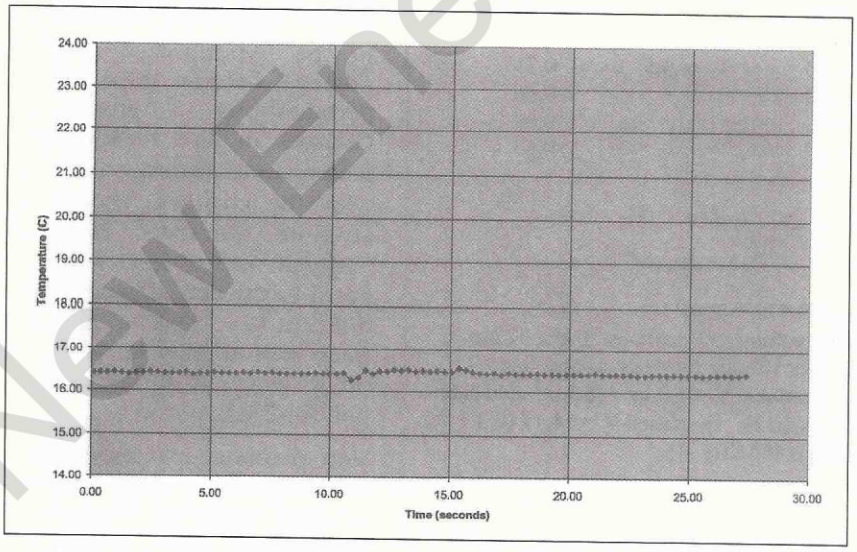

Figure 10. Temperature data for the system charged with air with a temperature difference across the regenerator, in constant pressure conditions.

See Figure 11. The up stroke (cooling) cold side thermocouple falls by several degrees and quickly rises, overshooting its pre-stroke value, and the down stroke (heating) cold side thermocouple rises by several degrees and quickly falls back to its pre-stroke value with some baseline turbulence seen again. The magnitude of the anomalous cooling ΔT is lower than the anomalous heating ΔT, explained by the breakthrough and bypass modalities identified before, which partly cancel the Proell effect self-refrigeration. Note that the Proell effect temperature spikes occur rapidly and the convection effects occur more slowly. The rapid Proell effect spikes *indicate the instantaneous nature of the work transfers*. The rapid re-equilibration of the temperatures is due to non-adiabatic Q flow; previous prototypes—made from insulating materials—produced step-like temperature responses that re-equilibrated much more slowly. Those insulated prototypes were not robust and they deteriorated after a few uses.

Figure 12 is the constant volume stroking of argon, and Figure 13 is the constant volume stroking of carbon dioxide.

When the gas confined in the device is changed, the ΔT_{SR} changes in proportion to the heat capacity ratio γ of the gas. Gases tested other than air have been nitrogen, argon, and carbon dioxide. The results measured in the author's crude test apparatus correlate with the γ values within 22% for the more substantial self-heating spikes. This is a key confirmation of the Proell effect. See Table 1. Four runs were done of each gas under constant volume conditions with a temperature differential.

After the constant volume data of Figures 11, 12, and 13 are understood, the constant pressure data of Figure 10 can be seen to have a miniature temperature excursion pattern just like what is seen in Figures 11 through 13. This could be residual Proell effect of the temperature spikes at the time of the strokes, caused by residual flow restriction from the use of a needle valve for venting the chamber to atmospheric pressure, or it could be Ideal Gas behavior caused by suction or compression from displacer motion.

It is now clear from the analyses in this paper that constant volume conditions produce the same energy transfers inside the regenerator as do constant pressure conditions. The distinction is that in isobaric conditions the work inside the regenerator is balanced by work to or from the atmosphere or the connecting work source or sink such as a compressor or an expander, while in isometric conditions the work inside the regenerator is balanced by the gas within the confined volume.

Arguments against the Proell effect's

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experimentally measured temperature anomalies have been presented to the author. The responses to the criticisms are indented for ease of identification.

• The thermocouple test results are artifacts or the thermocouples are faulty.

Correct thermocouple wiring was verified by applied heat.

Multiple thermocouples track each other, as seen in other test apparati.

Thermocouple outputs correspond in time to the strokes.

There is no noise problem with the thermocouple signals; resolution is generally about 0.02°C and background thermal fluctuations are about 0.1°C or less. Relative measurements are all that are necessary. Calibration is not needed because only relative change is needed to document the phenomenon.

• There is a prosaic explanation for the "anomalous" phenomenon.

The phenomenon is unknown in conventional science to the best of the author's knowledge. (At a bare minimum, this will mandate the revision of *all* textbooks on thermodynamics, in the opinion of my associate, Dr. Eugene Mallove.)

The phenomenon *is not* predicted by conventional thermodynamics, according to general principles. The Second Law of Thermodynamics denies a spontaneous separation of heat.

The phenomenon *is* predicted by conventional thermodynamics, *according to its fine details.*

Control tests of constant pressure at the same temperatures as constant volume, achieved by opening a valve to the apparatus, show no anomalous temperature changes, also in conformance with classical understanding.

Control tests of thermal equilibrium of the regenerator show no anomalous temperature changes, also in conformance with classical understanding.

• The anomalous temperature drops are too small compared to the predictions of the hypothesis to support the hypothesis.

When the argument is whether or not a phenomenon exists, all that is required to verify its existence is a measurement in that direction. The quality of the measurement is what is important, not the quantity. Is there evidence or is there not? Any result that is well beyond the background noise of the measuring technique will be evidence of its existence and we certainly have that. Optical and spectral observations in astronomy use this technique. Classical electricity and magnetism uses this technique, such as the repulsion of like charges in electrostatics.

Adjustment of stroke portion, using gases with different heat capacity ratios, and reducing pressure differential within the regenerator by the use of flow restrictors on the inlet side of the regenerator all give supporting evidence to the hypothesized phenomena, because these test permutations produce changes in the measured temperatures commensurate with the changes. Though absolute numbers range between 10 to 80% compared to theoretical, gases of different heat capacity ratios track within 25% of each other, which is strong support for the hypothesis.

Slow thermocouple response time, small leaks which compromise constant volume conditions, heat breakthrough from imperfect heat

Gas	Gamma	ΔT_{regen}	Cold Side ΔT_{SR}	Cold Side ΔT_{SH}	Theoretical $\Delta T_{SR/SH}$	Self-Heating Fraction of Theoretical
Air	1.40:1[83]	21°C	-2.0°C	+3.2°C	+/-4.1°C[84]	0.78
		21	-1.7	+3.0		0.73
		21	-1.9	+3.2		0.78
		21	-1.7	+3.2		0.78
Argon	1.67[85]	21	-2.0	+4.3	+/-6.8	0.63
		21	-3.0	+4.0		0.59
		21	-2.1	+3.8		0.56
		21	-2.0	+4.0		0.59
CO_2	1.30[86]	24	-0.8	+2.5	+/-3.5	0.71
		24	-1.5	+2.3		0.66
		24	-2.0	+2.1		0.60
		24	-1.1	+2.2		0.63

[83] 1997 ASHRAE Fundamentals Handbook, Atlanta, p. 19.77.
[84] The test apparatus has both hot and cold side minimum volumes. Equations 30 and 32 are given the following structure by substituting fractional bulk volume for mass, as absolute temperatures are nearly the same. Cold side minimum fractional V = 6.3 in^3 / (6.3 in^3 cold side min. V + 7.1 in^3 hot side min. V + 14.1 in^3 displaced V) = 0.229. Displaced V = 14.1 / (6.3 + 7.1 + 14.1) = 0.513. $\Delta T_{SR/SH} = (0.229 + 0.5(0.513)\Delta T(\gamma - 1) = 0.486\Delta T(\gamma - 1)$.
[85] 1997 ASHRAE Fundamentals Handbook, p. 19.81.
[86] Bueche, p. 276.

Table 1. Data associated with Figures 11-13. (Author references are sequentially out of order here because this paper is a condensed version of the original paper.)

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exchange, gas bypass of the regenerator from a poor displacer seal, and non-adiabatic conditions explain the low results.

• Joule-Thompson cooling caused by the displacer's differential pressure explains the anomalous results.

The J-T coefficient, $(\partial T/\partial P)_H$, for air at STP is vanishingly small because the temperature is nearly constant with a change in pressure at constant enthalpy. It will not show up with the conditions of these experiments and the measurement resolution of 0.02°C.

• Normal behavior for expansion or compression caused by the displacer's suction or compression explains the anomalous results.

Since the hypothesized effect is *not present* in constant pressure conditions as verified experimentally with an open vent on the hot side, and constant pressure conditions still have the ideal gas displacer suction and compression effects on the cold side, a lack of the anomalous T drop eliminates the purported "masking effect" of normal gas behavior.

No anomalous temperature changes are observed when the displacer is stroked while the system is in static, thermal equilibrium, being entirely at room temperature. Since the ideal gas behavior applies whenever the displacer is stroked, regardless of temperatures in the apparatus, the lack of a temporary temperature change with the stroking of the displacer when the apparatus is in thermal equilibrium also eliminates the purported masking effect of normal gas behavior. What is seen in Figures 8 through 10 may be due to normal gas behavior, but cannot explain the results of Figures 11 through 13.

• Since normal gas behavior is a masking effect to the purported effect, quantitative measurement is essential.

As explained above, normal expansion due to suction on the cold side is too small to explain the temperatures measured in Figures 11, 12, and 13.

The open hot side vent test adequately dismisses the normal gas behavior.

• There is a conventional heat pumping action hidden in the test apparatus.

No conventional heat pumping mechanisms have been identified.

By Ocham's Razor, the details of classical thermo provide the explanation.

• Gravity causes heating stroke anomalous heating by the release of potential energy upon decent.

As explained before, a lack of a temperature anomaly in thermal equilibrium and constant

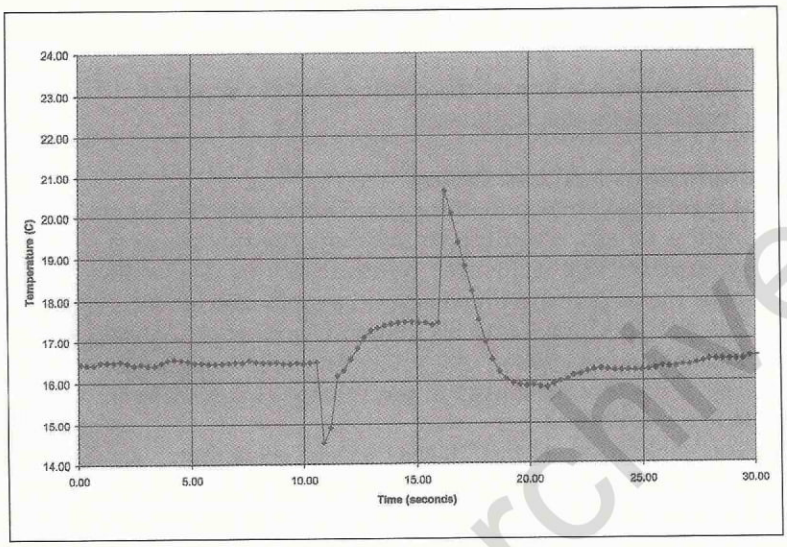

Figure 11. Temperature data for the system charged with air with a temperature difference across the regenerator, in constant volume conditions.

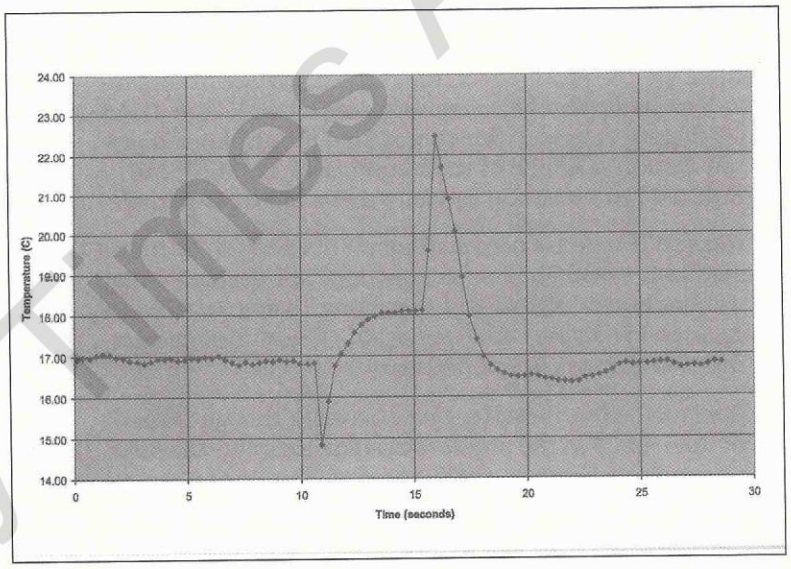

Figure 12. Temperature data for the system charged with argon with a temperature difference across the regenerator, in constant volume conditions.

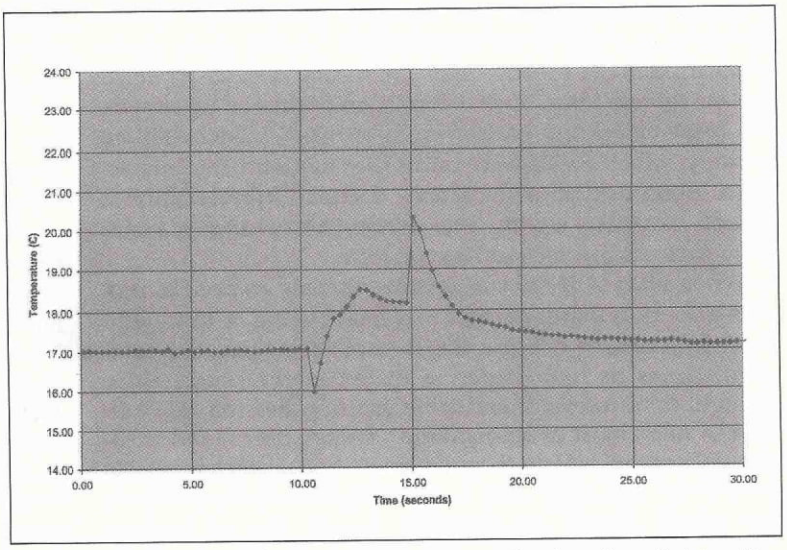

Figure 13. Temperature data for the system charged with carbon dioxide with a temperature difference across the regenerator, in constant volume conditions.

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pressure conditions with thermal differential disprove this explanation.

Anomalous cooling of the cooling strokes cannot be explained by this argument.

Conclusions and Discussion

The theoretical prediction of the Proell effect with the aid of analytical details according to standard thermodynamics, plus experimental evidence, prove that this Maxwell's Demon is true and confirmed beyond a reasonable doubt.

The true shock of Maxwell's Demon is not only the separation of heat in violation of Carnot's Theorem, but also the ability to use thermal energy in ways that we have not been able to do until now.

The implications of this Maxwell's Demon are that:

1) This Maxwell's Demon, incorporated into an engine cycle or a heat pump cycle, can in theory make them super-Carnot when the self-refrigeration or self-heating reservoirs are exploited.

2) The heat of the environment is available to do useful work. Since a super-Carnot heat pump or heat engine are possible via the Proell effect, the classical argument of pairing a heat pump and heat engine in contact with high T and low T thermal reservoirs which was used to "disprove" a perpetual motion machine of the second kind (PMM2)[14] can now be used to prove conceptually that a PMM2 *is* possible.

3) Thermal energy is a perpetual source of energy to be transformed into work. Thermal energy does not degrade under all circumstances and is self-sustaining, being capable of doing useful work over and over again. Once-through energy transformations are not necessary.

The Proell effect indicates that Maxwell's thought experiment does apply to the physical universe exactly as devised. The heat reservoirs created beyond the bounds of Carnot's Theorem allow PMM2s to be built that spontaneously cause a reduction in entropy. The Second Law of Thermodynamics must be amended to include negative entropy changes in isolated energy systems under certain conditions, limiting the Second Law's applicability by denying its presumed universality. *The Second Law does not apply when heat can transfer elastically according to the Kinetic Theory of Heat across greater distances between particles than statistically allowed for single particle pair collisions.* Such a condition creates an intermediate form of energy, pressure-volume work, which has no entropy, which breaks the statistically randomizing interactions upon which macroscopic thermal irreversibility is based. In other words, the Kelvin-Planck and Klausius Statements of the Second Law are *false*.

When unity efficiency is possible, there is no need to provide a specific source of heat to a heat engine. A unity efficient heat engine can use the classical heat sink, the environment, as its heat source. A major energy source, once thought to be forever unavailable, has now been made available to meet most of Humankind's energy needs, and without deleterious effects to our planet. It is always available and always has been, and is completely reusable, fulfilling our wildest dreams for abundant energy. The old sayings, "There is no such thing as a free lunch," and, "It is too good to be true," embody a perspective of our physical universe that now must change. This, along with other new energy sources now emerging, may be one of the largest paradigm shifts Humanity has ever experienced. Welcome to the future. Welcome to a new world of astounding potential, when devices based on the now verified Proell effect are eventually built into robust engines and heat pumps. It is, of course, possible that some as yet unknown error has crept into this methodology, but that will be for others to determine. For the author's part, no such error has been found after examining these results for three years.

The author presented the Proell effect and its engine and heat pump cycle designs to Dr. Peter Hagelstein, Professor of Electrical Engineering and Quantum Mechanics, from Massachusetts Institute of Technology, in May 2002. Professor Hagelstein found no flaws in the experiment. He was only able to suggest that the effect might be due to some kind of "chemical potential" at the air-regenerator interface.

The author mentioned the Proell effect phenomenon in discussion with Dr. John Wheeler, Professor of Physical Chemistry, from the University of California at San Diego. In email communication, Professor Wheeler now recognizes the Proell effect as real and as fully consistent with conventional science in its basic form. He intends to write a pedagogical paper for a mainstream physics journal on this subject, particularly as it relates to the Stirling cycle. He does not accept the author's claim that the Proell effect can be exploited to circumvent the Second Law, and does not recognize it as a Maxwell's Demon. The author met with Professor Wheeler at the Gordon Research Conference at the Holderness School, in Holderness, New Hampshire, on August 5, 2003; the Proell effect was demonstrated to Professor Wheeler and no alternate explanations were identified.

This research on the Proell effect was conducted while under the employment of Cold Fusion Technology, Inc., in its New Energy Research Laboratory (NERL), along with various cold fusion and other new energy investigations. This work on the Proell effect and its related applications were not reported in *Infinite Energy* at that time because of intellectual property concerns. Because of NERL's loss of funding (partly collateral damage of 9-11) and the resulting stagnation of the research, Dr. Mallove and the author decided to publish the basic science, which is in the public domain anyway with Wayne Proell's book. (However, particular embodiments of the technology which employ the effect are covered in patent-pending applications.) A manuscript of this work was submitted to *Foundations of Physics*, a mainstream scientific journal that has a history of publishing papers on controversial topics such as this. *Foundations of Physics* rejected the manuscript *without peer review*, citing its unusual nature and the strong opinion that favorable reviews would not be received from enough of the "referees." *Infinite Energy* was then selected as the publication venue for this valuable advancement in thermodynamics. We welcome feedback and amplifications from others—pro and con.

The author thanks Dr. Eugene F. Mallove of Cold Fusion Technology, Inc., and New Energy Foundation, Inc. for his support and assistance with the research and in the writing of this paper. Gratitude is also due to William Zebuhr of Ovation Products Corporation of Nashua, New Hampshire, for his review of the thermodynamic concepts of this paper, and to Peter and October Craig for their personal support of the author's efforts.

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Epilogue

This paper stands in stark comparison to mainstream, conventional thermodynamics. Because of the facts it contains and the conclusions that are drawn from them, one wonders how thermodynamics got so far afield that an adjustment based on these recent findings will have to be so severe. Percy Bridgman, 1946 Nobel Laureate in physics, wrote his perspective on the historical acceptance of scientific developments in the introduction of his book, *The Thermodynamics of Electrical Phenomena in Metals*. It illuminates one source of error in science and a good reason for the shock that this paper will undoubtedly create:

> The progress of physics is unsystematic. . .The result is that physics sometimes passes on to new territory before sufficiently consolidating territory already entered; it assumes sometimes too easily that results are secure and bases further advance on them, thereby laying itself open to future possible retreat. This is easy to understand in a subject in which development of the great fundamental concepts is often slow; a new generation appears before the concept has been really salted down, and assumes in the uncritical enthusiasm of youth that everything taught in school is gospel truth, and forgets the doubts and tentative gropings of the great founders in its eagerness to make applications of the concepts and pass on to the next triumph. . .But each new young physicist. . .is in danger of forgetting all the past rumination and present uncertainty, and of starting with an uncritical acceptance of the concepts in the stage of development in which he finds them.[15]

Addendum One: Second Law Analysis of the Proell Effect at Full Displacement

The Second Law of Thermodynamics, in its most basic form, has a mathematically rigorous definition: the net entropy change of an isolated system will be zero or greater than zero.

Three points are defined for this analysis, taking the system change through the isometric process. The initial and final points are mediated by another point corresponding to the classical isometric endpoint, Point 2. The actual endpoint, Point 3, is defined by the Proell effect. The analysis starts with air at 60°C = 140°F = 600°R on the hot side of a displacer, Point 1. The cold side of the displacer is 20°C = 68°F = 528°R, Point 2. By the Proell effect from complete displacement, the SR temperature change, creating Point 3, is

$$\Delta T_{SR} = ((1.40 - 1) / 2)\ (\Delta T = 600 - 528 = 72^\circ R) = \Delta 14^\circ R\ .$$

The final cold T is 514°R.

Point 1

Using the 1997 *ASHRAE Fundamentals Handbook* table for air at one atmosphere, page 19.77 (not shown here), 14.696 psia and 600°R = 140°F gives the following state variables,

P = 14.696 psia,
T = 600°R,
V = 15.13 cu ft / # (from the reciprocal of 0.0661 # / cu ft),
H = 143.47 Btu / #,
S = 1.6659 Btu / # °R,
Cp = 0.2408 Btu / # °F,
γ = 1.400,
U = 102.3 Btu / #,

where internal energy, U, does not appear on the table nor on the plot, and is derived from

H = U + PV, or
U = H - PV.

The conversion factor from psia cubic feet per pound to Btu per pound is multiplication by 0.1852. The math, shown once for example, is

(psia) (cu ft / #) = (psia) (cu ft / #) (1.013 x 10^5 N/m^2 / 14.696 psia) x ((12 in / ft) (2.54 cm / in) (m / 100 cm))^3 (1 J / Nm) x (1 Btu / 1054 J) = 0.1852 Btu / #.

(14.696 psi) (15.13 cu ft / #) (0.1852 Btu/# / psia cu ft/#) = 41.18 Btu / #,

U = 143.47 - 41.18 = 102.29 Btu / #.

Point 2

Point 2 is derived from the PH plot (not shown here), as the table does not list these conditions. Interpolated from the plot are the following points derived from the first two, given.

V = 15.13 cu ft / #,
T = 528°R,
H = 126.5 Btu / #,
S = 1.644 Btu / # °R.

Pressure is calculated from the Ideal Gas law as a change from Point 1, a more accurate method than interpolation.

constant = P_1V_1/T_1 = (14.7) (15.13) / (600) = 0.371.

P_2 = (constant) T_2/V_2 = (0.371) (528) / (15.13) = 12.9 psia.

U is calculated the usual way.

U = 90.4 Btu / #.

Point 3

Point 3 is also from the PH plot (not shown here), as pressure is not one atmosphere. The first two states are given. Pressure is also from an Ideal Gas calculation referenced to Point 1.

V = 15.13 cu ft / #,
T = 514°R,
P = 12.6 psia,
H = 123.0 Btu / #,
S = 1.640 Btu / # °R,
U = 87.7 Btu / #.

The heat capacity at constant volume, Cv, is calculated from the data from Point 1:

Cv = Cp / γ = 0.2408 / 1.400 = 0.1720 Btu / # °F.

The internal energy change from Point 1 to Point 3 is calcu-

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lated by two methods,

$\Delta U_{13} = U_3 - U_1 = 87.7 - 102.3 = -14.6$ Btu / #, and
$\Delta U_{13} = (\Delta T_{13})\ Cv = (514 - 600)\ (0.1720) = -14.8$ Btu / #.

The discrepancy between the two is due to plotting and interpolation errors which affects the state variables derived from the PH plot.

The entropy change of the air from Point 1 to Point 3 is

$\Delta S_{13} = S_3 - S_1 = 1.640 - 1.666 = -0.026$ Btu / # °R.

The entropy change of the regenerator is

$\Delta S_{regen13} = (Q_{13} = -\Delta U_{13})$ / (T_{regen} = the average of T_1 and T_2) = (14.8) / ((600 + 528) / 2 = 564 °R) = +0.0262 Btu / # °R.

The net entropy change of this isolated system, as a reversible isometric process has no work input or output, and therefore is simply

$\Delta S_{net} = \Delta S_{13} + \Delta S_{regen13} = -0.026 + 0.0262 \approx$ zero.

Addendum Two: Second Law Analysis of the Proell Effect at Partial Displacement

Another Second Law analysis is presented here, this time for partial displacement. For comparison, the same system as Addendum One is used with modifications for partial displacement.

Three points are defined for this analysis, taking the system change through the isometric process. The initial and final points are mediated by another point corresponding to the classical isometric endpoint, Point 2. The actual endpoint, Point 3, is defined by the Proell effect. Because partial displacement creates split states, the state variables at Point 1 are not as straightforward as in the previous analysis of full displacement. The analysis starts with some air at 60°C = 140°F = 599.8°R on the hot side of a displacer, and some air at 20°C = 68°F = 527.8°R on the cold side of the displacer.

Point 1

Using the 1997 *ASHRAE Fundamentals Handbook* table for air at one atmosphere, page 19.77 (not shown here), 14.696 psia and 599.8°R = 140°F gives the following state variables for the hot side of the displacer,

P = 14.696 psia,
T = 599.8°R,
V = 15.13 cu ft / # (from the reciprocal of 0.0661 # / cu ft),
H = 143.47 Btu / #,
S = 1.6659 Btu / # °R,
Cp = 0.2408 Btu / # °F,
γ = 1.400.

Internal energy, U, does not appear on the table nor on the plot, and is derived from

H = U + PV, or
U = H - PV.

The conversion factor from psia cubic feet per pound to Btu per pound is multiplication by 0.1852. The math, shown once for example, is

(psia) (cu ft / #) = (psia) (cu ft / #) (1.013 x 10^5 N/m^2 / 14.696 psia) x ((12 in / ft) (2.54 cm / in) (m / 100 cm))^3 (1 J / Nm) x (1 Btu / 1054 J) = 0.1852 Btu / #.

(14.696 psi) (15.13 cu ft / #) (0.1852 Btu/# / psia cu ft/#) = 41.18 Btu / #,

U = 143.47 - 41.18 = 102.29 Btu / #.

The state variables for the cold side of the displacer at Point 1 are still from the ASHRAE table, as pressure is still one atmosphere in both split states of Point 1. The interpolation factor between the lines of data at 60 and 80°F is

interpolation factor = (68 - 60) / (80 - 60) = 0.4000,

so

P = 14.696 psia,
T = 527.8°R = 68°R,
V = 0.4000 (0.0735 - 0.0763) + 0.0763 = 0.0752 # / cu ft = 13.30 cu ft / #
H = 0.4000 (129.03 - 124.22) + 124.22 = 126.14 Btu / #,
S = 0.4000 (1.6406 - 1.6315) +1.6315 = 1.6351 Btu / # °R.

U is calculated the usual way, but from the interpolated values above.

U = 89.94 Btu / #.

The average state variables which define Point 1 are calculated from the distribution between the hot and cold sides. Assume one pound of air is the total mass in the fixed volume. It is given that the mass of air is divided between hot and cold sides in Point 1 as 0.2 # on the hot side and 0.8 # on the cold side. Point 1's average state variables are as follows:

P = 14.696 psia,
T = 0.2 (599.8°R) + 0.8 (527.8∞R) = 542.2°R, where average T fits the Ideal Gas Law,
V = 0.2 x (15.13 cu ft / #) + 0.8 # (13.30 cu ft / #) = 13.67 cu ft/#,
H = 0.2 x (143.47 Btu / #) + 0.8 # (126.14 Btu / #) = 129.61 Btu/#,
S = 0.2 x (1.6659 Btu / # °R) + 0.8 # (1.6351 Btu / #) = 1.6413 Btu / °R/#,
U = 0.2 x (102.29 Btu / #) + 0.8 # (89.94 Btu / #) = 92.41 Btu/#.

Point 2

Point 2 is not a split state and one set of variables applies. The first two variables are given:

T = 527.8°R = 68°F,
V = 13.67 cu ft/#.

Pressure is most accurately calculated from an Ideal Gas derivation that references the tabulated variables of Point 1's hot side:

constant = PV/T = (14.696) (15.13) / (599.8) = 0.3707.

P_2 = (constant) T_2/V_2 = (0.3707) (527.8) / (13.67) = 14.31 psia.

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Enthalpy is nearly parallel to temperature in this range of the PH plot. Since the temperature of Point 2 is the same as the cold side of Point 1, the enthalpy is taken to be that of the cold side of Point 1:

$H = 126.1$ Btu / #

Entropy is linearly extrapolated from the PH plot by means of a ruler measurement of Point 3 between each isocline and perpendicular to the isoclines.

$S = 1.6374$ Btu / # °R

Internal energy is calculated in the usual way.

$U = 89.9$ Btu / #

Point 3

According to the Proell effect, the extra temperature change in isometric cooling, or self-refrigeration, SR, is

$\Delta T_{SR} = ((1.40 - 1)\ (X_{cold} + 0.5\ (X_{hot}) = 0.8 + 0.5\ (0.2) = 0.9))\ x\ (\Delta T = 542.2 - 527.8 = 14.4°R) = \Delta 5.2°R.$

The final cold T is

$T3 = T2 - \Delta T_{SR} = 527.8 - 5.2 = 522.6°R.$

The volume is still the same,

$V = 13.67$ cu ft/#.

Pressure is calculated from Ideal Gas Law relations as before:

$P = (\text{constant})\ T/V = (0.3707)\ (522.6) / (13.67) = 14.17$ psia.

The remaining variables of Point 3 come from the PH plot.

$H = 125.0$ Btu / #
$S = 1.6358$ Btu / # °R
$U = 89.1$ Btu / #

The heat capacity at constant volume, Cv, is calculated from the data from Point 1:

$Cv = Cp / \gamma = 0.2408 / 1.400 = 0.1720$ Btu / # °F.

The internal energy change from Point 1 to Point 3 is calculated by two methods,

$\Delta U_{13} = U_3 - U_1 = 89.1 - 92.4 = -3.3$ Btu, and
$\Delta U_{13} = (\Delta T_{13})\ Cv = (522.6 - 542.2)\ (0.1720) = -3.37$ Btu / #.

The discrepancy between the two is due to plotting and interpolation errors which affects the state variables derived from the PH plot. The second calculation has more precision and therefore is preferred.

The entropy change of the air from Point 1 to Point 3 is

$\Delta S_{13} = S_3 - S_1 = 1.6358 - 1.6413 = -0.0055$ Btu / # °R.

The entropy change of the regenerator is

$\Delta S_{regen13} = (Q_{13} = -\Delta U_{13}) / (T_{regen} = \text{the average of } T_1 \text{ and } T_2) = (3.37) / ((542.2 + 527.8) / 2 = 535.0\ °R) = +0.00630$ Btu / # °R.

The net entropy change of this isolated system, since a reversible isometric process has no work input or output, is simply

$\Delta S_{net} = \Delta S_{13} + \Delta S_{regen13} = -0.0055 + 0.00630 = +0.0008$ Btu / # °R.

The non-zero result is likely due to state variable inaccuracy, particularly the graphically interpolated values.

Addendum Three: Second Law Analysis of Maxwell's Demon

The Proell effect has been analyzed under two different conditions and found to conform to the mathematical definition of the Second Law of Thermodynamics, shown in Addenda One and Two. This seems odd because it effects a separation of heat, which normally is construed to be an ordering of the thermal energy and thus a decrease in entropy.

For comparison, the classical description of Maxwell's Demon, that of a partitioned gas enclosure, has been mathematically analyzed and found to likewise conform to the Second Law! The Second Law's mathematical definition is

$\Delta S_{net} \geq 0.$

State variables for a simple system were selected from the 1997 *ASHRAE Fundamentals Handbook*, p. 19.77, for air at one atmosphere. It is assumed that the system starts at thermal equilibrium at one atmosphere and ends at one atmosphere. The partition just happens to be where the mass is distributed properly at the end to produce no net pressure difference across the partition, and to split the total mass in half at the end of the transfer. Heat capacity at constant P is virtually unchanged throughout the Ts used, so the equal T deviations in the separation, high and low, reflect First Law balancing of Q between the two sides. For the sake of simplicity, the analysis starts with a total mass of one pound of air. Its initial state is given as

<u>Initial State</u>

Temperature, T_1 =	60°F,
Entropy, S_1 =	1.6315 Btu/#°F,
Mass, m_1 =	1 pound,
Heat capacity, Cp =	0.2403 Btu/#°F.

Its final state is given as

<u>Final State</u>

Temperature, T_{2hot} =	80°F,
Entropy, S_{2hot} =	1.6406 Btu/#°F,
Mass, m_{2hot} =	0.5000 pounds,
Heat capacity, Cp =	0.2404 Btu/#°F.
Temperature, T_{2cold} =	40°F,
Entropy, S_{2cold} =	1.6221 Btu/#°F,
Mass, m_{2cold} =	0.5000 pounds,
Heat capacity, Cp =	0.2403 Btu/#°F.

The change in entropy is

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$\Delta S_{net} = (S_{2hot} + S_{2cold}) - S_1 = 0.5(1.6406 + 1.6221) - 1.6315 = -0.0001$ Btu/#°F.

This negative system entropy change is at the resolution of the data and could reflect state variable inaccuracy.

Isn't it amazing that something as simple as this has not been identified before? Here is simple evidence that the foundations of science are not as solid as we thought.

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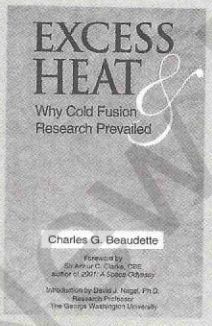

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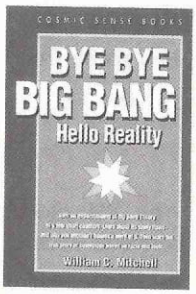

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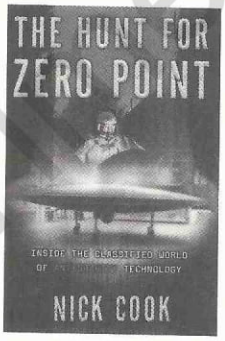

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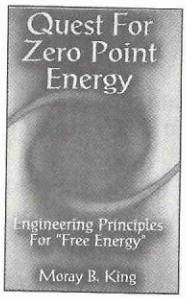

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The Direction of Starlight: Another Aberration of Modern Physics

Eugene F. Mallove

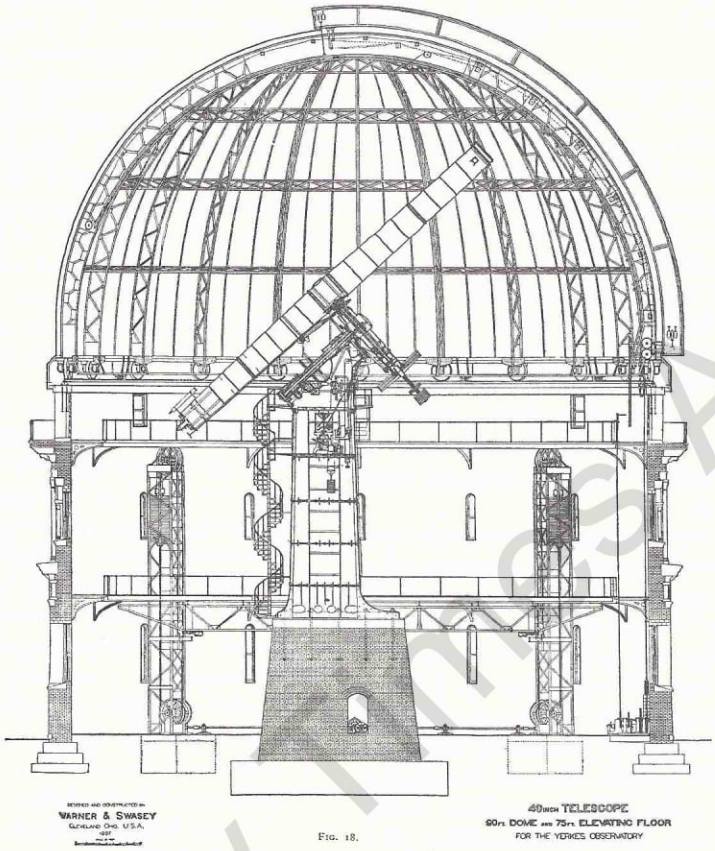

FIG. 18.

Tom Phipps' stimulating article, "Failures of Relativity Theory to Describe Starlight," (p. 36) critiques an important case in which modern physics obscures its inability to deal with issues arising from fundamental experimental measurements—in this instance something as basic as the apparent *direction* of light from stars, as it is affected by the *motion* of Earth.

Apart from whatever constitutes the actual fundamental physics of the universe, Phipps is able to show that Einstein's Special Theory of Relativity (SRT) apparently can't even explain a phenomenon of light that was discovered and "explained" classically almost three hundred years ago: *stellar aberration*, the apparent change in the direction of a star through the year due to Earth's orbital speed (about 30 km/sec) and its fractional relationship to the speed of light (about 300,000 km/sec). In this context it is remarkable to examine the propaganda from the Relativity establishment that SRT's alleged complete explanation of stellar aberration provides another reason to accept the theory! More on that later.

Many of you will not get through Tom Phipps' elegant mathematics—but by reading his article, you who are non-specialists should be able to pick up the gist of his arguments. But here first is a brief tutorial on stellar aberration and what Einstein could or could not say about it.

As you may be aware, until the advent of spaceflight in the 1950s, all astronomical observations were made from the surface of the Earth—a platform that rotates once daily with respect to the "frame of the distant stars." Knowing with accuracy and precision the *direction* of a particular star toward which one must point a telescope to observe it is thus fundamental to ground-based observational astronomy. It matters not at all (to any fundamental physics) that through the day, because of the Earth's rotation, the angle of the telescope tube with respect to the local horizontal and geographic north or south must constantly change. That is why both amateur and professional telescopes usually have motorized drive systems to keep the telescope tube pointed at a target star—compensating for Earth's rotation so that the star does not drift through the field of view while it is being observed. That is the most basic foundation for pointing a ground-based telescope.

Then comes what might be *thought* to be the next consideration in telescope pointing at stars—the *parallax view* or *perspective change* as Earth changes its position in its orbit. But even stars nearest to the Sun (within only 10 to 20 light years) are so very far away that for many practical purposes—certainly for most of amateur astronomy—they can be considered to be at an apparently infinite distance from Earth and its Sun. In other words, the stars might as well all be bright point sources of light *fixed* to a "celestial sphere" of huge radius, with our observation point being at the center of this imaginary sphere. Even the nearby stars have no readily observable *parallax*. In the eighteenth century, strenuous efforts were made to detect *stellar parallax*—that is, the shift in the *apparent direction* of a star (the angular position with respect to the even more distant field of background stars) caused by the different perspective afforded by Earth's changing position between the most distant points in its nearly circular orbit of the Sun (its positions about six months apart). Alas, such a stellar parallax (even for those nearby stars that should have the largest parallax or angular position change) was essentially impossible to observe with equipment that was available in the eighteenth century. In fact, the first stellar parallax—and therefore by simple trigonometry the actual distance to a nearby star—wasn't measured until 1838 by Friedrich Wilhelm Bessel in Germany. (It was already known that some stars changed their position markedly over the years due to their *proper motion*—their inherent nearly linear motion through

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space—and that the ones that had the greatest observed proper motions were likely to be the ones nearest to the Sun.) Bessel triumphed in finding that the nearby star 61 Cygni manifested annual parallax against the background stars of about 0.314 arc-seconds, which implied that this star was about 11 light years distant from the Sun. That is a very, very tiny parallax angle, considering that the Moon's apparent angular diameter (about 0.5 angular degree) is about 1,800 arc-seconds.

With this as background, the reader can understand what additional effect *stellar aberration*—caused by the velocity of the Earth—imposes on telescope pointing direction. It is a significant direction change, and is much bigger than stellar parallax. In fact, stellar aberration was serendipitously discovered by English astronomer James Bradley about a century earlier than Bessel's accomplishment, during Bradley's failed attempt to measure the elusive stellar parallax of nearby stars. The remarkable phenomenon of stellar aberration was in fact discovered and published by Bradley in 1728, long before Bessel measured the first stellar parallax. In that year he dispatched to the Astronomer Royal (Edmund Halley) an article, "Account of a New Discovered Motion of the Fix'd Stars," which described his observations a few years earlier and their interpretation.

As Phipps and many other commentators have pointed out, the stellar aberration effect on the direction of starlight has a convenient analogy to the apparent direction of vertically falling raindrops impinging on the umbrella of a person walking on level ground. The apparent direction of the rain drops with respect to the umbrella surface depends on the person's walking speed—specifically its ratio to the vertical speed of the falling rain. To insure maximum dryness, the walker is advised to tilt his umbrella appropriately into the apparent direction of the rain—changed from the vertical by the walking speed. Similarly, as Earth orbits the Sun, the apparent position of a star will actually change through the year—by a rather large amount (up to some 41 arc-seconds). Stars that are near to the projection onto the "celestial sphere" of the vertical to Earth's orbital plane appear to travel in a nearly circular path in the sky with a radius of 20.5 arc seconds, while stars close to the projection of Earth's orbit onto the celestial sphere travel back and forth through the year on a short line segment that is about 41 arc seconds long. Intermediate between the orbital plane and its pole, stars move on tiny elliptical paths. This stellar aberration effect, incidentally, as well as the far tinier and later-discovered stellar parallax, were the long sought final proofs of the Copernican theory that the Earth revolved about the Sun and not vice versa. Neither effect would be observed if the Sun revolved around the Earth. And, if the Earth were a rogue planet orbiting no sun, stellar aberration would be a constant shift in all stellar positions that could never be observed.

Stellar aberration is primarily a "first-order" effect in the ratio of Earth's velocity (v) to that of light (c), in other words an effect that depends only on the ratio v/c, which is about 10^{-4}, and not on v^2/c^2, which is a second-order effect term that actually does appear in equations governing SRT's "explanation." But the most basic intuitive attempt to understand the first order effect in stellar aberration fails to agree with SRT's requirement that no velocity exceed c! The very hypotenuse of the right triangle, with sides of lengths v and c, which should be the intuitive "resultant velocity of light," is obviously greater than c. Phipps says of this, ". . .Eddington's model does not generalize from rain to photons, and is in fact quite misleading in its application to light." Phipps also shows how other intuitive models of stellar aberration also fail, such as one put forward in 1946 by Bergmann. An experiment done in 1871 by Airy involving a water-filled telescope tube, which showed that—contrary to expectation—the water had no effect on the aberration of starlight. So, out the window goes Bergmann's explanation. Phipps devilishly teases in remarking that Einstein approved of the Bergmann book and that ". . .throughout his life Einstein was a leading simplifier of the stellar aberration phenomenon. Although unkind, it is fair to say that he never understood it well enough to grasp his own lack of understanding, and this applies to all modern physicists as well."

A case in point, one of my own physics professors at MIT in the mid-1960s, Anthony P. French. In his conclusion in Chapter 2 ("Perplexities in the Propagation of Light") of the MIT text authored by him, he writes:

> The phenomena that we have described in this chapter are such as to cause a strong sense of frustration in anyone who wishes to hold to the picture of light as waves in the ether. Every experiment designed to reveal our motion through this medium has the same result as though no motion existed, or as though the medium itself did not exist. The result of the Michelson-Morley experiment, like stellar aberration, is readily explained in terms of a ballistic [Ed. Note: *i.e.*, particle] model of light, in which the speed is uniquely defined with respect to the source, not with respect to a medium. It would be in perfect accord with what Galileo first recognized—that motions on a uniformly moving ship or other inertial reference frame do not, as observed within that frame, reveal any information about the velocity with which the whole system is translated. But in the view of most physicists at the end of the nineteenth century, a particle model was not relevant; one had to seek the explanations in the context of what seemed to be clearly a problem in wave propagation. And looking at the evidence, one could see that the only observations which did not give null results were those in which well-defined *relative* velocities were involved. In stellar aberration it was the velocity of earth at some point in its orbit relative to the velocity at some other point. In the Fizeau experiment it was the velocity of flowing water relative to the rest of the apparatus. And of particular concern was the seemingly direct conflict, from the standpoint of wave theory, between the existence of stellar aberration and the absence of any fringe shift in the Michelson-Morley experiment. As Einstein was the first to realize, the situation could not be met by a mere patching up of traditional theories. His radical and profound solution to the problem is the chief subject of the next chapter.

Then, of course, the "magic" solution of Einstein's two postulates is brought forth, and the poor unsuspecting MIT (and other) students are left with the distinct impression—

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so much intended—that SRT can explain all the litany of problems that arose with electromagnetism at the end of the nineteenth century, including stellar aberration.

It is very interesting how other authors address stellar aberration—if they address it at all—in discussing Einstein's SRT. For example, in discussing stellar aberration in the popular book, *Einstein's Legacy*, the late Julian Schwinger wrote: "This picture, of light moving in a straight line from a star to the moving Earth, gives a complete account of the observed changes in the direction of the star in the course of a year. But, if light moved in an ethereal medium that was dragged along with the moving Earth, no such effect would exist. To use the rain analogy, it is as though, when the person begins to walk, a wind springs up, driving the rain in the same direction, with the same speed, as the person moves. . .Not surprisingly, the Doppler effect, along with the aberration of light, was one of the topics discussed by Einstein in the epochal 1905 paper." That might be true, of course, if the cosmic ether was electromagnetic in nature—the so-called luminiferous ether of nineteenth century fame, which is what Schwinger was referring to. However, it is also true that clever theorists in the nineteenth century and later developed explanations of how even a luminiferous ether "dragged" or "entrained" by Earth might explain stellar aberration.

Both French and Schwinger (and their like) go far astray in thinking that SRT can explain stellar aberration. Phipps provides the necessary antidote to this more than four-score year charade of shoving an important issue under the rug to preserve widespread acceptance of Special Relativity. One of Phipps' central points is that it is critical to define what the "relative velocity," v, really is in the matter of stellar aberration. Much rides on the necessity to maintain the empirically observed apparent identity of the aberration paths (ellipses or circles) of stars that are close together in the sky. But this is not possible to do because of various conflicting requirements on how the all-important v is defined—whether it is a v describing "source-sink" relative velocity or a v as orbital velocity of Earth. SRT's house of cards—its spatialization of time and mixing of space and time—comes tumbling down. Phipps concludes, "Consistent description of all the observable properties of starlight (at least a two-parameter job) by means of a one-parameter group lies permanently beyond the capabilities of SRT or any other theory." Phipps conscientiously goes through various attempts that have been made to rescue SRT, or to apply other types of theories to explain stellar aberration with consistency. He finds so far insurmountable problems on all fronts.

There is a possible "out" for SRT, Phipps notes (with tongue firmly planted in cheek). At the very least, he suggests, radio astronomers should (in the radio frequency domain) attempt to determine the magnitude of the second order term, v^2/c^2, for describing stellar aberration, which differs among alternative theories to SRT. Very Long Baseline Interferometry (VLBI) using multiple radio-telescope dishes around the world should be able to readily resolve source direction to 10^{-4} arc seconds, he says—about 20 times higher resolution than required to discriminate among several noted theories and SRT. Perhaps SRT would "luck out" and show that it had the better prediction of the second-order term. Even were that to be found, it would not resolve the other intractable difficulties that the Phipps analysis reveals. The bottom line is that light—in the context of conventional and most non-conventional theories—remains profoundly enigmatic. Much stronger medicine needs to be taken to escape this conundrum. Very few heretic physics theories may be up to this.

Will mainstream physics take even the first step toward acknowledging a problem? Unlikely, thinks Phipps, and I agree. He writes: "In a less sophisticated era it would have gone without saying that the mere advent of the technical capability to *test* important unverified predictions of an accepted physics theory imposed upon physicists an unspoken moral obligation to pull up their socks and do that testing. Nowadays it is a different matter. Funding dictates the morality of science, not to mention its integrity. And now that Einstein has been apotheosized, it has become a breach of faith to doubt His Word by openly suggesting that it be tested."

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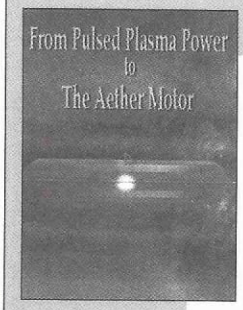

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Failures of Relativity Theory to Describe Starlight

Thomas E. Phipps, Jr.*

This paper was presented at the *Natural Philosophy Alliance* meeting in Storrs, Connecticut, June 2003.

"...science cannot exist but in minutely organized particulars."
– Wm. Blake, *Jerusalem*, Ch. 3

Stellar Aberration: An Appreciation of the Phenomenon

Stellar aberration is a phenomenon [Bradley (1728)] observed at first order in (v/c); hence it is generally treated as "classical" in nature. This view is epitomized in Arthur Eddington's explanation of the need to tilt the telescope slightly away from the "true" direction to a star, by his famous "umbrella" analogy: A man with an umbrella, running at speed v through rain falling vertically at speed c, must tilt his umbrella forward through an angle whose tangent is (v/c) in order to stay as dry as possible. This deduction is facilitated by consulting a vector triangle whose perpendicular sides are v and c, and whose hypotenuse is therefore of length $\sqrt{c^2 + v^2}$. The result is correct for rain, and the model correctly suggests that "forward" with respect to the Earth's motion is the right direction to tilt the telescope. . .moreover to first order (given proper interpretation of "v") the suggested angle of tilt is correct. However, the fact that the hypotenuse of the vector triangle, representing the relative speed of light traveling down the telescope tube, exceeds c should alert us that something is amiss. In fact, if that leg of the triangle is shortened to match the presumed speed limit c, this closes up the aberration angle to zero. Thus the phenomenon is not explained at all, compatibly with the existence of a limit on the speed of light. Consequently Eddington's model does not generalize from rain to photons, and is in fact quite misleading in its application to light.

> . . .Einstein was a leading over-simplifier of the stellar aberration phenomenon. Although unkind, it is fair to say that he never understood it well enough to grasp his own lack of understanding, and this applies to almost all modern physicists as well.

Another attempt to concoct a first-order model of the phenomenon was made by Bergmann (1946) as follows: ". . .when a light ray enters the telescope, let us say from straight above, the telescope must be inclined. . .so that the lower end will have arrived straight below the former position of the upper end by the time that the light ray has arrived at the lower end." If that were true, then filling the telescope with water, which has a refractive index greater than unity and hence slows the light passing through the tube to speed $c' < c$, would observably change the stellar aberration angle from $\tan^{-1}(v/c)$ to $\tan^{-1}(v/c')$. The experiment was done by Airy (1871), with no such result: the water was found to have no effect whatever on stellar aberration. It seems that the harder people try to over-simplify the phenomenon by classical models, the less they understand it. (We may add that Bergmann's book had Einstein's approval, and that throughout his life Einstein was a leading over-simplifier of the stellar aberration phenomenon. Although unkind, it is fair to say that he never understood it well enough to grasp his own lack of understanding, and this applies to almost all modern physicists as well.)

The fact is that starlight gives us a tantalizing glimpse into the "most quantum" phenomenon in nature, the large-scale non-local action of the quantum of light. We shall never get closer to a personal apperception of the quantum world, and of the meaning of quantum non-locality as well as of localized "process completion," than we do through the act of viewing starlight. The physicist, if he is to enter into the quantum world with any degree of understanding must bare his head and acknowledge that he stands in the presence of something recognizable (for his professional purposes) as holy. In that way he can get over his temptation to trivialize the phenomenon by classical models—including special relativity theory (SRT). A first step toward grasping the cogency of this last observation is to review what SRT has to say on the subject. We shall find that SRT, in its own mathematically impeccable way, goes every bit as wrong physically as either of the two classical attempts mentioned above.

Stellar Aberration According to SRT

Appendix A provides an analysis, borrowed from the textbooks, of stellar aberration according to SRT. To recapitulate the main points: In two inertial systems S and S', which are in relative motion at speed v along their common x-axes, we define a four-vector $k_\mu = (\mathbf{k}, i\omega / c)$, $\mu = 1,2,3,4$, of starlight propagation in S and its counterpart k_μ' in S'. The three-vector $\mathbf{k}$, of magnitude $k = 2\pi/\lambda$, is a ray-vector normal to the plane-wave surface representing the propagating starlight, and $\omega = 2\pi\nu$ is its angular frequency. The two four-vectors are related by the Lorentz transformation. Since $k = \omega/c$, we can introduce direction cosines (l,m,n), satisfying $l^2 + m^2 + n^2 = 1$, for the spatial part of the four-vector in S and express the four-vector as $k_\mu = (kl, km, kn, ik)$ or $k_\mu/k = (l, m, n, i)$. The

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scalar product of this four-vector with itself is $\Sigma_\mu k_\mu k_\mu / k^2 = l^2 + m^2 + n^2 - 1 = 0$, which shows that k_μ is a null vector. Similar relations hold for k_μ'. From the Lorentz transformation we find $k_\mu' / k' = (l', m', n', i)$, where

$$ck' = \omega' = \omega\gamma\left(1 - \ell v / c\right), \text{ with } \gamma = 1/\sqrt{1 - v^2/c^2}\ , \quad (1)$$

expresses the Doppler frequency shift. The **k**′ three-vector, specified in direction by

$$\left(\ell', m', n'\right) = \left(\frac{\ell - v/c}{1 - \ell v/c}, \frac{m}{\gamma\left(1 - \ell v/c\right)}, \frac{n}{\gamma\left(1 - \ell/c\right)}\right),$$

is slightly turned in S' from the direction (l, m, n) of the **k**-vector in S. The angle Δ between these two three-vector directions has a cosine equal to the scalar product of the two unit vectors. Thus $\cos\Delta = ll' + mm' + nn'$. Solving this for Δ and expanding the result in powers of (v/c), we get

$$\Delta = \sqrt{1 - \ell^2}\left(\frac{v}{c}\right) + \frac{\ell\sqrt{1 - \ell^2}}{2}\left(\frac{v}{c}\right)^2 + O\left[\left(\frac{v}{c}\right)^3\right].$$

For the special case in which the Earth is moving directly toward the star, the direction cosine l specializes to $-\sin\theta$, where θ is the polar angle measured downward from the zenith (normal to the plane of the ecliptic in which the Earth moves), this reduces to

$$\Delta = \cos\theta\left(\frac{v}{c}\right) - \frac{\cos\theta\sin\theta}{2}\left(\frac{v}{c}\right)^2 + O\left[\left(\frac{v}{c}\right)^3\right]. \quad (2)$$

The first-order term here in (v/c) agrees with observation, if and only if v is interpreted as Earth's *orbital velocity*, so that $(v/c) \approx 10^{-4}$ radian, or about 20.5 arc sec. The factor $\cos\theta$ describes a projection onto the celestial sphere of the Earth's almost circular orbit. The resulting elliptical "figure of aberration" becomes circular near the pole ($\theta \approx 0$) and degenerates to a line near the plane of the ecliptic ($\theta \approx 90°$).

The textbooks that mention the second-order term in the Δ expansion all say that it is too small to be observed. But in fact that is no longer true. With the advent of the VLBI (Very-Long Baseline Interferometry) system it is said that angles can be resolved down to 10^{-4} arc sec, or about 5×10^{-10} radian. Thus the second-order term of order 10^{-8} radian should be readily measurable if the system's accuracy is comparable to its resolution. It is quite important for basic physics that such measurements be made, for we shall now indicate conceptual difficulties faced by SRT that bring its higher-order descriptive competence into question.

SRT: What is v?

A distinguishing feature of SRT is that it depends on four-vectors obedient to the Lorentz transformation. Four-vectors possess "spacelike" and "timelike" parts, but the distinction is said to have "faded to mere shadows," in Minkowski's memorable phrase. This fading is particularly evident in the case of the magnetic and electric parts of four-vectors descriptive of Maxwellian fields, for which inertial transformation deconstructs and "scrambles" these parts, so that electric and magnetic fields become linear combinations of each other's components. The Lorentz transformation that does this scrambling depends on a single relative velocity parameter v and defines a one-parameter group. (Actually, in more than one spatial dimension a rotation must also be introduced—a hidden postulate—in order to retain group properties, but we set aside this complication by confining attention here to the "special" Lorentz transformation in one spatial dimension.) To make physics of the mathematics outlined in the preceding section, it is necessary to evaluate the group parameter v or—which is the same thing—to identify the physical inertial systems S and S'.

In the case of the timelike part of the k_μ four-vector, the frequency part, governed by Equation 1, namely, for the case $\theta = 90°$ ($l = -1$) of light from a retreating source (emitting frequency ω' as measured in its rest system S') and propagating anti-parallel to the velocity v of S' relative to S,

$$\left(\frac{\omega'}{\omega}\right)_{\ell=-1} = \gamma\left(1 + \frac{v}{c}\right) = \frac{1 + v/c}{\sqrt{1 - v^2/c^2}} = \sqrt{\frac{1 + v/c}{1 - v/c}},$$

which implies $\omega < \omega'$, a Doppler downshift of the frequency ω as measured by a detector at rest in S. Similarly for an approaching source the sign of v is changed, which brings about a Doppler upshift, $\omega > \omega'$. All of this is in agreement with observation if and only if v is interpreted as the *source-sink relative velocity*,

$$v = v_{ss}\ . \quad (3)$$

Inertial system S is identified as the rest system of the light detector or telescope, and S' is identified as the rest system of the light source or star. The v_{ss} parameter has numerical values that differ from star to star. If v_{SS} were the same for all stars at a given polar angle θ, we would lose our Doppler distance scale for the size of the universe and would in fact infer that we lived in a geocentric universe whose rate of "expansion" varied systematically with its relationship to the plane of the ecliptic and annually with the time of year [value of l, as in Equation 1]. Since this is nonsense, the relativists are undeniably right in accepting Equation 3 as correctly identifying the Lorentz group parameter for transforming the timelike (Doppler frequency) part of k_μ.

Now we come to the bitter bit. We have already noted that the empirically correct velocity parameter for transforming the spacelike (stellar aberration) part of k_μ is

$$v = v_{orb}, \quad (4)$$

the orbital velocity of the Earth. The reason, aside from the need to get agreement with the facts of stellar aberration (known since Bradley), is an observed property of star images that may be termed "conformality." That is, in any small region of the night sky all stellar images move in concert, each annually progressing around its elliptical "figure of aberration" in such a way as to maintain its apparent relationship to all its neighbors. (We leave aside the few stellar objects so near us as to show measurable parallax.) If source-sink relative velocity [Equation 3] governed observable stellar aberration, this property of conformality would be lost,

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since that would mean that different figures of aberration would be observed for differently-moving stars. There would be no single figure of aberration for all stars in a given region of the celestial sphere, contrary to fact. Empiricism thus demands that the Lorentz transformation be parameterized independently of source motion, hence independently of source-sink relative motion. So, Equation 3 is ruled out for describing the spacelike part of k_μ, and Equation 4 must be accepted instead.

Since all velocities are "relative," we have to ask what the velocity in Equation 4 is relative to. Many relativity texts say that it is relative to the Sun. . .and this is not numerically wrong. But it brings in a third party that has nothing to do with the observable phenomenon. Bradley did not have a telescope on the Sun, yet he measured stellar aberration. At least one writer [Synge (1965)] has proposed a more cogent alternative, that the parameter v_{orb} be recognized as the velocity of the telescope (or Earth) relative to itself at two different times. That is, we focus attention upon *changes* of the telescope tilt angle $\delta\Delta$, and recognize that these track (actually, in phase quadrature) the corresponding changes δv_{orb} of the Earth's orbital velocity vector. The systems S and S' are thus the instantaneous rest systems of the telescope at two different times. In particular, if those two times are exactly one year apart, the Earth returns to rest in its initial quasi-inertial system S—with the consequence that there is zero relative velocity between S and S', and zero observable change of the star's position on the celestial sphere, so that the relative velocity parameter of Equation 4 must be taken to be zero. Thus in Equation 4 v_{orb} cannot be assigned a single scalar numerical value, but must be interpreted as the relative velocity of inertial systems S and S' in which the Earth is momentarily at rest at two arbitrarily separated times. No third party ["tertium quid"—*cf.* O'Rahilly (1965)] need play a part.

Aside from eliminating the physically irrelevant, what advantage does the Synge interpretation have over the "Sun" reference adopted by most text writers? Most significantly, it calls attention to the crucial role of *detector non-inertiality* for observability of the stellar aberration phenomenon. This is a matter of physics—hence seldom noted by physicists. As long as the light detector is in a purely inertial state of motion, no aberration is observable. Without changes of the detector velocity vector, stellar aberration is not a measurable quantity. Contrast this with the Doppler effect, a phenomenon readily detectable in permanently inertial systems. It is hard to avoid the inference that the two phenomena, stellar aberration and Doppler shift, are physically as well as mathematically (parametrically) completely unrelated. . .in short that the attempt to "weld" them together into a four-vector is physical as well as mathematical nonsense. When the distinction between apples and oranges has faded to mere shadows, the same will be true of stellar aberration and the Doppler effect.

In summary of our considerations so far, we assert that

- The k_μ descriptor of starlight is a four-vector if and only if it obeys the Lorentz transformation.
- The (special) Lorentz transformation depends on a single parameter v and defines a one-parameter group. To claim otherwise is to invent a new theory to replace SRT.
- In order to describe the Doppler effect of starlight it is necessary to take $v = v_{ss}$, the source-sink relative velocity.
- In order to describe stellar aberration it is necessary to take $v = v_{orb}$, the orbital velocity of the Earth.
- These two v-parameter evaluations are different, $v_{ss} \neq v_{orb}$, in the same mathematical sense that $1 \neq 2$.
- The attempt to describe starlight by the Lorentz transformation of a four-vector thus fails. SRT fails ideologically: The weld between the spacelike and timelike parts of k_μ fails *at the seam*. It is not true that the distinction between spacelike and timelike parts of k_μ fades to mere shadows.
- This failure of SRT is both a mathematical failure of consistent parameterization and a physical failure to comprehend the inertial vs. non-inertial prerequisites of observability. Consistent description of all the observable properties of starlight (at least a two-parameter job) by means of a one-parameter group lies permanently beyond the capabilities of SRT or any theory.
- Nevertheless, despite a catastrophic conceptual failure, SRT has one final chance to redeem itself as a purely empirical theory descriptive of stellar aberration. The second-order term in Equation 2 is a definite, inescapable consequence of the SRT formalism. If VLBI observations confirm this prediction, the failures of SRT will be at least partially redeemed. Needless to say, observations are required. Physics needs in this matter to reaffirm its empirical under-pinnings.

Various Attempts to Reconcile v_{ss} with "Conformality"

Suppose Einstein was right in thinking that source-sink relative velocity plays a central role in stellar aberration as well as in the Doppler effect. This still would not cure the parameter inconsistency that invalidates the k_μ "four-vector" of starlight, but it would do much to reaffirm the idea of physical relativity of motion. We review here a number of suggestions or hypotheses aimed at such a clarification of the underlying physics.

(1) *"Differential Aberration"*

Let us for sake of argument concede that the transformation between two inertial systems, S and S', in fact has nothing to do with the observable phenomenon of stellar aberration—all the existing relativity textbooks to the contrary notwithstanding. Instead let us posit that the observable phenomenon is a differential one that depends on taking the *difference* of two four-vectors. We think of the corresponding v-parameter in the Lorentz group as represented at first order by a source-sink relative velocity at time t

$$v_{ss}\,(t) = v_{orb} - v_{star}$$

Similarly, six months later, the same parameter can be represented as

$$v_{ss}\,(t + 6mos.) = -v_{orb} - v_{star},$$

it being assumed that in six months the star's velocity has not changed (source in quasi-inertial motion), whereas the Earth's orbital velocity has reversed its sign. Taking the difference of the corresponding four-vectors, we find that the star velocity cancels out,

$$\Delta v_{ss} = v_{ss}\,(t) - v_{ss}\,(t + 6mos.) = (v_{orb} - v_{star}) - (-v_{orb} - v_{star}) = 2v_{orb}.$$

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Since $2v_{orb} / c = 2 \times 10^{-4}$ radian = 41 arc sec = major axis of the figure of aberration, it would seem that we have solved our problem of reconciling source-sink relative velocity with the "conformality" property of star images. Unfortunately, there are fatal troubles with this argument.

Trouble #1:
The differencing of starlight four-vectors works for spacelike description but not for timelike, as can be seen from the fact that the influence of source motion on Doppler shift subtracts out when the differencing is done. . .so all stars (to first order) have the same Doppler shift. Hence the differenced Δk_μ lacks spacetimelike symmetry and therefore is still not a satisfactory four-vector for SRT purposes.

Trouble #2:
Even worse, the whole differencing idea proves contrary to observable fact. As was first pointed out by Herbert Ives (1950), for most stars of the class termed spectroscopic binaries it is known that $v_{star}(t) \neq v_{star}\ (t + 6mos.)$, so the above first-order cancellation of source motion effects does not occur. The difference Δv_{ss} should thus show an observable Δv_{star} residue due to source motion change, the result of which would be to cause the spectroscopic binaries to exhibit aberrations different from their neighbors. Such a predicted effect contradicts conformality and is denied by observation. This was pointed out by Hayden (1993) for visual binaries as well. Thus differential aberration offers no viable solution to SRT's problem.

(2) *"Ray Selection"*
The majority of stellar objects may be assumed to radiate omni-directionally. Suppose the angle of emission of the light ray reaching the Earth varies for each differently-moving source star, in such a way as to cancel or compensate the differences in source velocity. One can express this basic idea in terms of a purely classical "duck-hunter" model. The star is a hunter who seeks to hit a duck (the Earth) flying by. He must aim his gun differently for each value of the source-sink relative velocity v_{ss}. (Actually, the hunter is firing machine guns in all directions!) The correct bullet trajectory to hit the target differs for each differently-moving hunter (star). The lethal trajectory corresponds to a light-ray path that is differently selected for each star. The idea that this cancels the effect of source motion and causes the duck to see the bullets coming at it with a property of conformality is not clear to this writer, who has never seen a mathematical analysis or demonstration of such a claim. Moreover, the claim denies the Einstein postulate that source motion does not affect light propagation. But it is possible that that postulate needs refinement. Conceivably, it might be restated in the form that source motion does not affect light speed but can affect light propagation direction. However, there is no need to speculate, as ray selection should be demonstrable. That is, it is a testable proposition.

Test:
Find a stellar object that is not radiating omni-directionally but is "beaming" strongly almost exactly toward the Earth. That is, the Earth lies on the steeply-sloping side of the main light intensity profile. If Earth-star relative velocity changes in fact cause different rays emitted at slightly different angles to be detected (at different times) on Earth, the selected ray will move annually back and forth along the intensity profile, causing the Earth's relative motion to contribute an *annual variation* of the star's *intensity* as measured on Earth. This would not prove the full proposition, that ray selection accounts for conformality, but it would confirm the ray selection mechanism and offer SRT some possible wiggle room. This is an area in which it is dangerous to take anything for granted.

(3) *"Extinction"*
Curt Renshaw (on his website) proposes treating stellar aberration via the assumption that stellar photons are many times absorbed and re-radiated. Thus the effect of source motion is rapidly "extinguished," in conformity with ideas of Fox, who claimed an extinction distance of about two light years. Thus all the stellar images we see in the night sky are re-radiations from a distance of about two light years. Hence for these secondary sources $v = v_{ss}$ and conformality is explained if all the nearby (re-radiating) sources are in similar states of motion. It may be presumed that this would not require literal co-motion of these secondary sources but merely their thermalization to a common temperature. Here again it is more efficient and definitive to test than to speculate.

Test:
It may be assumed, from the nature of the exponential law, that extinction is imperfect out to perhaps twenty to thirty light years from Earth. Therefore, for such nearby stars extinction should not be complete, so some "original photons" that have suffered zero scattering events during their passage to Earth should be detectable. These (not re-radiated) photons should carry information on true source motions. If, indeed, source-sink relative velocity is what determines where we should point our telescope, then such original photons should produce faint separate images, different from the main images produced (supposedly) by re-radiations from nearer sources. The presence or absence of faint extra images associated with such nearby stars should test the extinction hypothesis.

(4) *"Ether(s)"*
Ether theories almost always address the topic of stellar aberration, and thus tend to be more in touch with reality than does SRT. Still, the present writer finds it hard to think in terms of ethers, and so must leave this rich field open for treatment by its own enthusiasts. As to the physics, the phenomenon of "polarization of the vacuum" leaves little room for doubt as to the physical existence of a space-filling ether. Even Einstein came to this view. But that leaves open the possibility, *e.g.*, of a Dirac-type "relativistic ether," which possesses no preferred state of motion, but occupies all states, and thus provides no "absolute space" as a motional referent. . .and certainly no demonstrated basis for the "extinction" of source motion effects by ethereal interaction, as is needed to account for the conformality property of stellar aberration.

Miscellaneous Insights and Guesses about Light

Can a study of the stellar aberration phenomenon provide insight into the nature of light, the physics of propagation, etc? The average physicist—or, more accurately, the leading bell-wethers of the profession—would deny this and inform the student that Maxwell's equations tell him all he needs to know about the subject. But Maxwell's equations have so many deficiencies it is almost embarrassing to enumerate them. Let us mention the leading three: 1) They give no hint of the physical existence of photons. 2) They are not invari-

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> In a less sophisticated era it would have gone without saying that the mere advent of the technical capability to *test* important unverified predictions of an accepted physics theory imposed upon physicists an unspoken moral obligation to pull up their socks and do that testing. Nowadays it is a different matter. Funding dictates the morality of modern science, not to mention its integrity. And now that Einstein has been apotheosized, it has become a breach of faith to doubt His Word by openly suggesting that It be tested.

ant at first order in (v/c) (*i.e.*, under Galilean transformation), hence they conflict with the relativity principle at first order. 3) They are under-parameterized, inasmuch as they contain parameters descriptive of field source motions but none to describe field sink motions. (Since fields are unverifiable without the tangible presence of sinks or absorbers, and since "relativity" of motion without parameters to describe relative motions of *all* tangible objects is a contradiction in terms, it follows that Maxwell's equations are the worst possible place to start building anything called a *relativity theory*.) Heinrich Hertz introduced a variant of Maxwell's theory that was capable, with proper physical interpretation, of correcting the second and third of these deficiencies at first order. He did this through introduction of an extra velocity parameter that broke the spacetime symmetry of the field equations (see Appendix B for details).

An interesting new conception of the nature of light was first proposed by Moon and Spencer (1956). Their model of the propagation of light is used by them to establish a "universal time." This model is one that the present writer terms "radiation convection by the emitter." It is one of three contending models considered by Spencer (1996) and her coworkers. The first is Einstein's view of light as leaving the emitter without any subsequent influence of its state of motion; so that the center of the expanding light sphere permanently coincides with the emission point. The second is the Ritzian model, according to which the expanding light sphere is ballistically hurled by its emitter; so that after emission the center of the light sphere tracks the position the source would have if it continued in inertial motion after the emission event. The third, or radiation convection by the source, model is the extension of the Ritz idea to the case in which the center of the expanding light sphere continually tracks the instantaneous position of the emitter regardless of its state of motion, whether inertial or accelerated. In this case the light sphere continually expands at speed c relative to its center at the moving emitter.

To these models the present writer must add one designated "convection of light by the absorber." This is complementary to the third model mentioned above, in that one could picture a light sphere shrinking at speed c, which tracks the arbitrary motion of the absorber. This weirdly acausal idea did not spring from the brow of Zeus, but is a deduction from the Hertzian invariant form of electromagnetic theory sketched in Appendix B. In the Moon-Spencer model (1956) the photon is accorded no separate degrees of freedom from its *source*, but moves with it, as it were, "rigidly" in the classical sense. In the complementary view, convection by the *absorber*, the photon is accorded no degrees of freedom separate from its absorber, so it moves rigidly and instantly with its absorber or detector. As Feynman once thought, the absorber in the latter model is truly the "mechanism" of radiation, and could even be said to be a rigidly-connected "part" of the radiation (as long as the radiation photon remains "virtual" or non-local, prior to localized "process completion"). Which, if any, of these models has any physics in it will depend on experimental predictions and tests. They are mentioned here only to stretch the reader's mind a bit. The truth is that "propagation" is such a largely *mind*-supplied product that almost any story can be told about it that correctly describes the *observable* quantum localization terminating it. So far only Einstein's *mind* has been allowed to tell a credited or investigated story about light propagation. The result has been a systematic impoverishment of physics and of the human imagination. . .in effect, a stagnation of basic science throughout the half-century since his death.

Stellar Aberration: Predictions of Three Theories

The strange, acausal theories of light propagation just alluded to may seem frivolous or wholly speculative, but they submit to being tested by observation—a much better way of refuting them than by theoretical dictat or ridicule. For comparison, we repeat the SRT prediction, Equation 2, for the aberration angle $\Delta_{\phi=0}$:

$$\Delta_{SRT} = \cos\theta\left(\frac{v}{c}\right) - \frac{\cos\theta\sin\theta}{2}\left(\frac{v}{c}\right)^2 + O\left[\left(\frac{v}{c}\right)^3\right],$$

The corresponding prediction for the theory ("convection by the emitter") of Domina Eberle Spencer and her group is

$$\Delta_{DES} = \cos\theta\left(\frac{v}{c}\right) - \cos\theta\sin\theta\left(\frac{v}{c}\right)^2 + O\left[\left(\frac{v}{c}\right)^3\right].$$

The present writer's theory ("convection by the absorber") predicts (see Appendix B)

$$\Delta_{TEP} = \cos\theta\left(\frac{v}{c}\right) \qquad + O\left[\left(\frac{v}{c}\right)^3\right];$$

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that is, the second-order term is rigorously absent, so that the VLBI system, with 5 x 10^{-10} radian resolution, should be unable to measure any departure from the classically predicted figure of aberration; *viz.*, a projection of the Earth's orbit onto the celestial sphere (first-order term). The third-order terms, of order 10^{-12} radian for all theories, are entirely undetectable.

In a less sophisticated era it would have gone without saying that the mere advent of the technical capability to *test* important unverified predictions of an accepted physics theory imposed upon physicists an unspoken moral obligation to pull up their socks and do that testing. Nowadays it is a different matter. Funding dictates the morality of modern science, not to mention its integrity. And now that Einstein has been apotheosized, it has become a breach of faith to doubt His Word by openly suggesting that It be tested. One shudders to think of the Limbo, Purgatory, or Hell that awaits the infidel who tests It and gets the wrong answer. For this reason, anyone smitten by charity must hesitate to insist that old-time experimental protocols be applied to the question of shape modification of the figure of stellar aberration. After all, the VLBI system has been around for a number of years, and the Einstein-predicted second-order shape modification has been around for much longer. If it were politically expedient to put these two together into a research program, that would surely have been done long ago. Why spend money to prove what funding administrators already know and dare not doubt? Best to leave sleeping dogs lying.

Finally, it should be said that we have barely scratched the surface of the subject of aberration. There is planetary aberration, solar and lunar aberration, "streetlight" aberration, etc., that we have not touched upon. If these seem a simple matter, easily reduced to textbook formulas, rest assured that this is in itself an aberration. In all cases, in interrogating the quantum pure state of the "propagating" photon, we are poking our foot into the basic fabric of the world. . .and need to tread gently.

Acknowledgment

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Appendix A. SRT Analysis of Stellar Aberration

Special relativity theory (SRT) describes a one-way propagating plane-wave or ray of starlight in an inertial system S by a four-vector $k_\mu = (\mathbf{k}, i\omega / c)$, $\mu = 1,\ldots,4$, where $\mathbf{k}$ is a three-vector of magnitude $k = 2\pi/\lambda = 2\pi\nu/c = \omega/c$, directed along the wave normal, and $\nu = \omega/2\pi$ is the light frequency (as affected by Doppler effect). In studying stellar aberration we may focus attention on monochromatic radiation idealized as plane waves, in recognition of the great distances of all stellar sources from Earth. For simplicity we treat our telescope as situated above the atmosphere of a uniformly-moving non-rotating Earth, to avoid all concerns with non-inertiality, or with refraction and dispersion, consequently with distinctions among phase velocity, group velocity, energy velocity, etc. We begin by reviewing the standard formal SRT treatment of the subject.

As with all four-vectors, the sum of the squares of the four components is an invariant, in this case zero. Thus $\Sigma_\mu k_\mu k_\mu = k_\mu^2 = \mathbf{k} \bullet \mathbf{k} + (i\omega/c)^2 = k^2 - \omega^2/c^2 = 0$ is a null vector. This merely expresses the fact that $ck = \omega$ or $\lambda\nu = c$ in vacuum. Propagation in vacuum takes the photon from its source atom in the star to its earthly detector, which we suppose to be another atom in the photo-detector of a telescope sharing the state of motion of the Earth. Our given wave-normal or ray of starlight is described by $(\mathbf{k}, i\omega/c)$ in an inertial system S and by $(\mathbf{k}', i\omega'/c)$ in another inertial system S'. For the moment we need not identify these systems physically, but shall merely turn the crank of the formalism. According to SRT, the two four-vectors have components that can be related by the special Lorentz transformation,

$$k_1' = \gamma\left(k_1 + i\frac{v}{c}k_4\right), \quad k_2' = k_2, \quad k_3' = k_3, \quad k_4' = \gamma\left(k_4 - i\frac{v}{c}k_1\right), \tag{A-1}$$

where $\mathbf{k} = (k_1, k_2, k_3)$, $k_4 = i\omega/c$, $\gamma = 1/\sqrt{1 - v^2/c^2}$, etc., v is the velocity of S' relative to S, and the relative motion of S and S' is directed along their shared x-axes. Null invariance of the four-vector is preserved in S', $\mathbf{k}' \bullet \mathbf{k}' + (i\omega'/c)^2 = k'^2 - \omega'^2/c^2 = 0$.

Let us follow SRT textbook procedures [Aharoni (1965)] to learn how the k_μ four-vector transforms. We may introduce direction cosines $l = \cos\alpha$, $m = \cos\beta$, $n = \cos\gamma$ in S, so that $\mathbf{k} = (k_1, k_2, k_3) = (kl, km, kn)$, where $l^2 + m^2 + n^2 = 1$. Since $k = \omega/c$, we can write our four-vector in S as $ck_\mu = (\omega l, \omega m, \omega n, iw)$. In S' the same light ray is described by $ck'_\mu = (\omega' l', \omega' m', \omega' n', i\omega')$. The Lorentz transformation (1) then yields

$$ck_1' = \omega'\ell' = \gamma\left(\omega\ell + (iv/c)(i\omega)\right) = \gamma\omega\left(\ell - v/c\right) \tag{A-2a}$$

$$ck_2' = \omega' m' = \omega m \tag{A-2b}$$

$$ck_3' = \omega' n' = \omega n \tag{A-2c}$$

$$ck_4' = i\omega' = \gamma\left(i\omega - (iv/c)\omega\ell\right) \quad \text{or} \quad \omega'/\omega = \gamma\left(1 - \ell v/c\right). \tag{A-2d}$$

Equation A-2d expresses the relativistic Doppler effect. From Equations A-2 we obtain the transformation formulas for the direction cosines,

$$\ell' = \gamma\frac{\omega}{\omega'}\left(\ell - \frac{v}{c}\right) = \frac{\ell - v/c}{1 - \ell v/c}, \quad m' = \frac{\omega}{\omega'}m = \frac{m}{\gamma\left(1 - \ell v/c\right)}, \quad n' = \frac{\omega}{\omega'}n = \frac{n}{\gamma\left(1 - \ell v/c\right)}. \tag{A-3}$$

It is a simple algebraic exercise to verify that $l'^2 + m'^2 + n'^2 = 1$, so the transformed quantities are indeed direction cosines in S'. Also, we note that when multiplied by c these relations reduce to the light velocity composition laws obtained by differentiating the Lorentz transformation equations [Møller (1972)]. From these general relations we can determine at once how much the light ray or telescope axis changes its direction in 3-space in the change from S' to S. By vector analysis, or from the geometry of direction cosines, we know that the cosine of the angle Δ between the two unit vectors $\mathbf{k}/k$ and $\mathbf{k}'/k'$ (*i.e.*, between the wave normals in S and S') is the scalar product $ll' + mm' + nn'$. This "classical" relation holds because under the special Lorentz transformation the spatial coordinate axes in S and S' retain their parallelism, so directions and changes of direction in the two spaces are

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unambiguously defined by projections onto the coordinate axes. Using $m^2 + n^2 = 1 - l^2$, we find from (A-3)

$$\Delta = \cos^{-1}\left[\frac{\ell(\ell - v/c)}{1-\ell v/c} + \frac{m^2}{\gamma(1-\ell v/c)} + \frac{n^2}{\gamma(1-\ell v/c)}\right] = \cos^{-1}\left[1 - \frac{(1-\ell^2)\left(1-\sqrt{1-v^2/c^2}\right)}{1-\ell\frac{v}{c}}\right] \tag{A-4}$$

$$= \sqrt{1-\ell^2}\left(\frac{v}{c}\right) + (1/2)\ell\sqrt{1-\ell^2}\left(\frac{v}{c}\right)^2 + (1/6)\sqrt{1-\ell^2}\left(1+2\ell^2\right)\left(\frac{v}{c}\right)^3$$

$$+(1/8)\ell\sqrt{1-\ell^2}\left(1+2\ell^2\right)\left(\frac{v}{c}\right)^4 + (1/40)\sqrt{1-\ell^2}\left(3+4\ell^2+8\ell^4\right)\left(\frac{v}{c}\right)^5 + O\left(\left(\frac{v}{c}\right)^6\right).$$

The expansion of arc cosine in powers of (v/c) here is a bit tricky and rather interesting, but since the interest is purely mathematical we shall take the result as given.

Considering angles to be defined as in Figure A-1, we have

$$(l, m, n) = (-\sin\theta\cos\phi, \sin\theta\sin\phi, -\cos\theta). \tag{A-5}$$

the signs signifying downward propagation of the starlight. Opposite signs could equally well be used, signifying upward pointing of the telescope. Although only one parameter, $l = -\sin\theta\cos\phi$, appears in the expansion (A-4), it depends on two angles, the polar angle θ and the azimuthal or orbital angle ϕ, the latter varying with the time of year. It is well-known (since Bradley) that over the course of a year any given star traces out on the celestial sphere a small ellipse of semi-major axis a and semi-minor axis b, known as the "figure of aberration." This ellipse is roughly the projection along the mean direction to the star of the Earth's (approximately circular) orbit onto the celestial sphere. Thus for a star near the zenith (θ small) the figure of aberration is almost a circle, whereas toward the horizon (θ near 90°) it becomes flattened into a line. Holding θ constant at some intermediate value, we note that as the Earth progresses counter-clockwise around its orbit (ϕ varying) the star's position on the projected elliptical figure of aberration advances synchronously, but with a 90° phase advance—*i.e.*, in phase quadrature. When $\phi = 0°$ we see from Figure A-1, that the Earth is advancing directly toward the star, and that the aberration angle Δ is a minimum, corresponding to the b-value (semi-minor axis) of the projected ellipse, $\Delta_{mm} = b$. Three months later, when $\phi = 90°$, Δ is a maximum, corresponding to the semi-major axis $\Delta_{max} = \alpha$. These extremal properties can be verified directly from the coefficient $\sqrt{1-l^2}$ of the dominant term in (A-4). For $\phi = 0°$, $\sqrt{1-l^2} = \sqrt{1-(\sin\theta)^2} = \cos\theta$, which is minimal for the given θ-value; and when $\phi = 90°$ we have $l = 0$ and $\sqrt{1-l^2} = 1$, which is maximal. A convenient measure of stellar aberration that should be readily measurable is the ratio of the semi-axes,

$$\frac{b}{a} = \frac{\Delta_{min}}{\Delta_{max}} = \frac{\Delta(\ell = -\sin\theta)}{\Delta(\ell = 0)} = \cos\theta - (1/2)\cos\theta\sin\theta\left(\frac{v}{c}\right) + (1/3)\cos\theta\sin^2\theta\left(\frac{v}{c}\right)^2$$

$$-(1/4)\cos\theta\sin\theta\left(\frac{1}{6}+\sin^2\theta\right)\left(\frac{v}{c}\right)^3 + (1/5)\cos\theta\sin^2\theta\left(\frac{2}{9}+\sin^2\theta\right)\left(\frac{v}{c}\right)^4 + O\left(\left(\frac{v}{c}\right)^5\right). \tag{A-6}$$

The leading term here, $\cos\theta$, corresponds to the projection of the Earth's circular orbit on the celestial sphere. Owing to a small ellipticity of the actual orbit, these calculations would have to be modified in application, but the circular-orbit approximation will serve to illustrate the qualitative features we wish to bring out here.

In particular, the crucial point is that SRT predicts a *first-order* departure of the *shape* of the figure of aberration from the simple classical Earth's-orbit projection recipe ($\cos\theta$). Since the angular figure of aberration itself is of order (v/c) radian [*cf.* Equation A-4], this alteration of its shape requires measurements of order $(v/c)^2$. When Bergmann (1946) wrote his book, he stated that "the relativistic second-order effect is far below the attainable accuracy of observation." But since then the observational situation has changed dramatically. With the advent of VLBI long-base interferometry, it is claimed that angles can be resolved to around 10^{-4} arc sec, or roughly 5×10^{-10} radian. The value of (v/c) is about 10^{-4} radian. Therefore $(v/c)^2$ effects, of order 10^{-8} radian, should be readily measurable. An opportunity thus arises for astronomers to perform a crucial test of SRT in an area (special relativistic shape modification of the figure of aberration) not hitherto studied, as far as the writer knows. To do this would be an important service to physics.

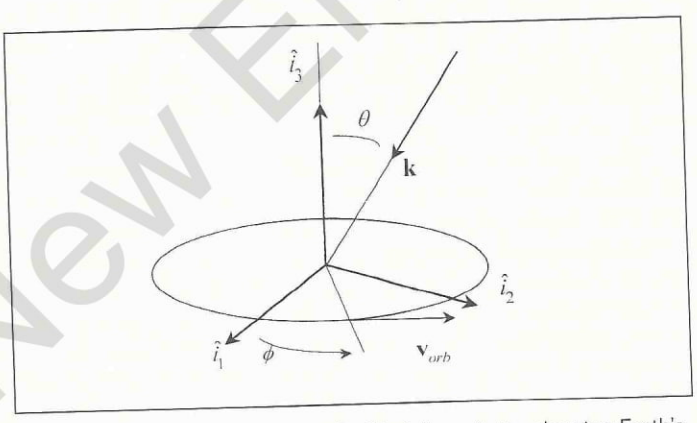

Figure A-1. Earth's orbit in plane $(\hat{i}_1, \hat{i}_2)$ of the ecliptic, showing Earth's position at azimuth ϕ and orbital velocity v_{orb}; also fixed **k**-vector of starlight propagation at polar angle θ, lying in fixed plane $(\hat{i}_2, \hat{i}_3)$ normal to the ecliptic.

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Appendix B. Neo-Hertzian Alternative Theory

We shall give here as brief a summary as possible of a coherent line of theoretical development alternative to that of SRT. This has been described in greater detail elsewhere [Phipps (1986, 1995)]. SRT is a kinematic contrivance to correct—and ultimately to hide—the shortcomings of Maxwell's equations. One of the more glaring of these shortcomings is their failure to exhibit invariance at first order (*i.e.*, under Galilean inertial transformations). Thus there is a first-order denial of the relativity principle. Einstein patched this up by boldly abandoning invariance (*sang pur*), thus giving up on first-order physics and resorting instead to second-order considerations embodied in Lorentz covariance. Covariance is not at all the same thing as invariance, although notations have been skillfully devised to make it appear so. To match this retreat from invariance, the relativity principle was reinterpreted to accommodate covariance instead of invariance, and the discarded remnants of first-order physics were left to the gorillas.

In addition to their lack of invariance, Maxwell's equations had another grievous shortcoming. They were inadequately parameterized, in that, although field sources could move, field

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sinks could not. (Thus $\mathbf{j} = \rho\mathbf{v}$ allowed arbitrary field source motions, but the theory contained no corresponding velocity parameter to describe the motion of a field sink, absorber, or detector.) This was a serious omission, since no EM field or other quantum process exists (verifiably) without its detector. . .and no legitimate relativity theory can be built without sufficient parameters to allow all tangible things in nature to move relatively to all others. That is the essence of the "relativity" idea. Einstein's version of relativity made bricks without straw, by ignoring the parameter deficiency and compensating that error by substituting covariance for invariance.

Heinrich Hertz discovered an elementary way to make Maxwell's equations invariant at first order. He accomplished this by introducing an extra velocity parameter $\mathbf{v}_d$, through the simple expedient of replacing the partial time derivative $\partial/\partial t$ wherever it appeared in the field equations with the total time derivative $d/dt = \partial/\partial t + \mathbf{v}_d \bullet \nabla$. The resulting equations for vacuum EM were formally invariant under the Galilean transformation, and thus offered legitimate relativization via adequate parameterization. Unfortunately, Hertz was not sensitive to the need to relativize, and (in the spirit of his times) wrongly interpreted his new parameter as "ether velocity." This brought Hertz's equations into conflict with observation (after his death) and caused them to be discarded by physicists. However, his equations were formally superior to Maxwell's (a) because of their first-order invariance, and (b) because they were a *covering theory* (reducing identically to Maxwell's theory in the limit $v_d \to 0$, implying $d/dt \to \partial/\partial t$). Physicists today generally recognize invariant covering theories as superior descriptors. Hertz could have avoided all conflict with first-order observation through interpretation of his new parameter $\mathbf{v}_d$ as field detector (absorber) velocity, measured relatively to the same observer's inertial system as the field source term $\mathbf{j}$. That corrects the parametric deficiency mentioned above, as well as the failure of invariance—thus killing two birds with one stone.

Einstein's inspiration to hurdle over first-order physics, employing second-order tricks of "universal covariance" to dodge the need to get first-order physics right on its own terms, was one of the historic blunders of physical theory in the twentieth century. Still, in my opinion, he did get one supremely important thing right. His discovery that time-keeping (the rate of clocks) is motion-dependent (more generally, energy state dependent, to cover changes of gravity potential) is well-supported empirically. This discovery is incorporated in his definition of the invariant proper-time interval in terms of inertial frame time, $d\tau^2 = dt^2 - dr^2/c^2$, which implies $d\tau/dt = \sqrt{1-(v/c)^2}$. Interpreted as the "pocket watch time of the co-moving observer," this $d\tau$ is something all observers can agree on, and is not subject to the insufferable restriction to "purely inertial systems" that mocks SRT at every turn. It is the one aspect of SRT that is reasonably sure to stand the test of time. Unfortunately, the ideologist Minkowski got hold of this and, with a mathematician's true disregard of reality, insisted on the equal *physical invariance* of the (literally) imaginary counterpart, $d\sigma = id\tau$. For this there has never been any empirical evidence (nobody having yet built an instrument that gives imaginary numerical readings). Yet this claim is the ultimate basis for an alleged "spacetime symmetry" that has turned physics into an adjunct of pure mathematics—thereby writing finis to serious physics in our time. The writer's own ideology treats invariance as holy, not to be aped by devil's dodges such as covariance, and never to be invoked without plentiful empirical support. To be invariant is to be real. . .else physics loses its link to reality, becoming centered more on the describer than the described. Whatever exists tangibly "out there" can and must be described invariantly. The writer is no philosopher, but he feels that operationalism has suffered unjustly from a bad press. The slightest attention to the *instruments* that *measure* "fields" and to their states of motion, during the past hundred years, would have unmasked the conceptual black hole at the center of modern field theory.

In securing first-order invariance of the field equations of electromagnetism (EM) Hertz used higher-order *non-invariant* "frame time" t to define his total time derivative d/dt. The above considerations tell us at once how to correct this non-invariance and secure higher-order invariance. We have merely to replace Hertz's "t" by the invariant proper time τ_d of the field detector to obtain an invariant temporal description of EM, as well as an observer-independent understanding of the new field detector velocity parameter $v_d^{(\tau)}$. Once we have detector motion invariantly parameterized, our EM theory is liberated from the particular state of motion of the "observer," who now becomes merely an instrument reader (one of many possible ones). We are thus able to describe the readings of a particular instrument, as seen by observers in arbitrary ("general") states of motion, and need not introduce a set of inertial observers, each equipped with his own comoving detection instruments, as is necessary in Maxwell-Einstein EM theory. To make the field equations generally invariant, we thus employ the double replacement

$$\partial/\partial t \to d/dt \to d/d\tau_d \to \partial/\partial\tau_d + \mathbf{v}_d^{(\tau)} \bullet \nabla,$$

where $v_d^{(\tau)}$ is the proper-time derivative, related to frame-time detector velocity $\mathbf{v}_d$ by

$$\mathbf{v}_d^{(\tau)} = \frac{d\mathbf{r}}{d\tau_d} = \frac{d\mathbf{r}}{dt}\frac{dt}{d\tau_d} = \frac{1}{\sqrt{1-(v_d/c)^2}}\frac{d\mathbf{r}}{dt} = \gamma_d\,\mathbf{v}_d\,. \quad \text{(B-1)}$$

Since Hertz broke "spacetime symmetry" *at first order* by introducing a treatment of time mathematically asymmetrical with respect to the spatial partial derivatives, and since a symmetry lost at first order cannot be restored at higher orders, it follows that we have no motive to go beyond physical evidence in the matter of space mensuration. There being no direct empirical evidence for the Lorentz contraction, we might as well postulate Euclidean length as our spacelike invariant. Hertz treated length as invariant at first order, and there is no compelling reason to improve on that treatment. Thus ∇ remains at higher orders a rigorously invariant operator. These considerations enable us to postulate the higher-order invariant equations of vacuum EM to be

$$\begin{aligned}
&\nabla\times\mathbf{B} - \frac{1}{c}\frac{d\mathbf{E}}{d\tau_d} = \frac{4\pi}{c}\mathbf{j}_{III}\\
&\nabla\times\mathbf{E} + \frac{1}{c}\frac{d\mathbf{B}}{d\tau_d} = 0\\
&\nabla\cdot\mathbf{B} = 0\\
&\nabla\cdot\mathbf{E} = 4\pi\rho\,.
\end{aligned} \quad \text{(B-2)}$$

where $\mathbf{j}_{III}$ is the source current density measured by an instrument comoving with the field detector and τ_d is the proper time of the latter. Thus everything about field theory depends on

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what the *field detector* is doing. Equations B-2 are *manifestly invariant*, as each symbol transforms in place into its own image, including $\mathbf{E}' = \mathbf{E}$ and $\mathbf{B}' = \mathbf{B}$. . .given, of course, that $c' = c$. (Clearly, these Hertzian fields are not the same as Maxwellian fields. We have already alluded to the crucial difference in operational definition: In Maxwell-Einstein physics each inertial observer is possessed of his own "private" **E** and **B** field detectors at rest relative to himself; whereas the single Hertzian **E** and **B** field detector is "public" property, viewable by arbitrarily-moving observers. Since in both theories there is only a *single* field point and measurement time, the Maxwell-Einstein view implies collisions of macroscopic instruments, and fails completely in the weak-field limit—because a single field quantum can be detected in at most a single macro instrument.) Equation B-2 is invariant under general coordinate transformations, since it may be considered to describe the readings of a single instrument in arbitrary relative motion—readings which will be the same regardless of the observer's motion. Only with the introduction of non-invariant inertial frame time t, via Equation B-1, does *inertiality* of relative motion come into EM field theory of the present type, which we have termed "neo-Hertzian." Such a t-introduction, though, is almost unavoidable in practical applications.

In order to discuss stellar aberration from the neo-Hertzian viewpoint, we need to solve the invariant wave equation,

$$-\nabla^2 \mathbf{E} + \frac{1}{c^2}\frac{d^2}{d\tau_d^2}\mathbf{E} = 0\,. \tag{B-3}$$

which is derived directly from (B-2). Following d'Alembert, we look for a solution of the form $\mathbf{E} = \mathbf{E}(p)$, where $p = \mathbf{k} \bullet \mathbf{r} - \omega t = xk_x + yk_y + zk_z - \omega t$. We see that

$$\nabla^2 \mathbf{E}(p) = \left(\frac{\partial^2}{\partial x^2} + \frac{\partial^2}{\partial y^2} + \frac{\partial^2}{\partial z^2}\right)\mathbf{E}(p) = \left(k_x^2 + k_y^2 + k_z^2\right)\mathbf{E}''(p) = k^2\mathbf{E}''\,,$$

where each prime denotes a differentiation with respect to p. Using Equation B-1, we find similarly, for constant $\mathbf{v}_d^{(\tau)}$, implying also a constant frame-time velocity $\mathbf{v}_d$, that

$$\frac{d^2}{d\tau_d^2}\mathbf{E}(p) = \gamma_d \frac{d}{dt}\gamma_d \frac{d}{dt}\mathbf{E}(p) = \gamma_d^2\left(\frac{\partial}{\partial t} + \mathbf{v}_d \cdot \nabla\right)^2 \mathbf{E}(p) = \gamma_d^2\left[\frac{\partial^2}{\partial t^2} + 2\frac{\partial}{\partial t}(\mathbf{v}_d \cdot \nabla) + (\mathbf{v}_d \cdot \nabla)^2\right]\mathbf{E}(p)$$
$$= \gamma_d^2\left[\omega^2 - 2\omega(\mathbf{v}_d \cdot \mathbf{k}) + (\mathbf{v}_d \cdot \mathbf{k})^2\right]\mathbf{E}'' = \gamma_d^2\left[\omega - (\mathbf{v}_d \cdot \mathbf{k})\right]^2 \mathbf{E}''.$$

Combining these results, we have from (B-3)

$$\left\{-k^2 + \frac{\gamma_d^2}{c^2}\left[\omega - (\mathbf{v}_d \cdot \mathbf{k})\right]^2\right\}\mathbf{E}'' = 0\,.$$

From the vanishing of the coefficient of $\mathbf{E}''$ we deduce that $ck = \gamma_d|\omega - \mathbf{v}_d \bullet \mathbf{k}|$ or that phase velocity u in neo-Hertzian EM (in vacuum) obeys

$$u = \frac{\omega}{k} = \pm\sqrt{c^2 - v_d^2} + \frac{\mathbf{k}}{k}\cdot \mathbf{v}_d\,. \tag{B-4}$$

This suffices to allow the study of stellar aberration and Doppler effect. [For the latter, see Phipps (1986).]

The general analysis of stellar aberration based on (B-4) has been given in Phipps (1991), where it is shown by straightforward vector analysis that the aberration angle is

$$\Delta = \tan^{-1}\left[\frac{v_d}{c}\left(\frac{1-\ell^2}{1-(v_d/c)^2}\right)^{1/2}\right] = \sqrt{1-\ell^2}\left(\frac{v_d}{c}\right) + \frac{1}{6}\sqrt{1-\ell^2}\left(1+2\ell^2\right)\left(\frac{v_d}{c}\right)^3$$
$$+\frac{1}{40}\sqrt{1-\ell^2}\left(3+4\ell^2+8\ell^4\right)\left(\frac{v_d}{c}\right)^5 + O\left(\left(\frac{v_d}{c}\right)^7\right). \tag{B-5}$$

Referring to the geometry shown in Figure A-1, we can take $l = \sin\theta\cos\phi$, as before. Proceeding as in Appendix A, we arrive at the following result, in accord with the 1991 analysis, for the ratio of semi-minor to semi-major axis of the aberration ellipse on the celestial sphere:

$$\frac{b}{a} = \frac{\Delta_{min}}{\Delta_{max}} = \frac{\Delta(\ell = \sin\theta)}{\Delta(\ell = 0)} = \frac{\tan^{-1}\left[\dfrac{v_d\cos\theta}{\left(c^2 - v_d^2\right)^{1/2}}\right]}{\tan^{-1}\left[\dfrac{v_d}{\left(c^2 - v_d^2\right)^{1/2}}\right]} = \cos\theta + \left(\frac{1}{3}\right)\cos\theta\sin^2\theta\left(\frac{v_d}{c}\right)^2$$
$$+\left(\frac{1}{5}\right)\cos\theta\sin^2\theta\left(\frac{2}{9} + \sin^2\theta\right)\left(\frac{v_d}{c}\right)^4 + O\left(\left(\frac{v_d}{c}\right)^6\right). \tag{B-6}$$

Here v_d is detector speed—the detector being our telescope, which moves with the Earth at orbital speed v_{orb}. Changes in tilt angle track those in orbital velocity, in phase quadrature, with the image leading the Earth by 90°. Source speed and source-sink relative speed do not enter, in agreement with observation. Of particular importance in (B-6) is the absence of a first-order term in (v_d/c) and of other odd-order terms. (Observe that Equations A-6 and B-6 agree in their even-order terms, and A-4 and B-5 agree in their odd-order terms. The coincidence is quite unexpected.) This distinguishes the neo-Hertzian prediction from that of SRT (Appendix A), as embodied in Equation A-6. It is clear that neo-Hertzian EM *predicts no observable departure* from the classical elliptical projection of the Earth's orbit on the celestial sphere, even at the high degree of refinement of angle measurement characterizing the VLBI system (≈5 x 10^{-10} radian), since the second-order shape modification in (B-6) requires third-order aberration angle measurements of order 10^{-12} radian; whereas we have seen that the SRT prediction of a first-order shape departure (10^{-8} radian measurements) should be readily verified quantitatively. A crucial experiment is thus available, and another opportunity for SRT to exhibit its superiority to all rivals.

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About the Author

Dr. Phipps is retired from the U.S. Naval Ordnance Laboratory (White Oak, Maryland). He is the author of *Heretical Verities*, and of nearly one hundred publications in physics journals.

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ECLECTIC OBSERVER

Compiled by Eugene Mallove

Wall Street Journal Science Column Addresses Cold Fusion Conundrum

Sharon Begley's "Science Journal" column in *The Wall Street Journal* (Friday, September 5, 2003, p. B1) was a commentary, not a news account, about the Tenth International Conference on Cold Fusion (ICCF10), which was held in Cambridge, Massachusetts near and at MIT, August 24-29, 2003. Ms. Begley attended ICCF10 for the first two days of the conference proper—September 25-26. Her piece was bannered appropriately: "Cold Fusion Isn't Dead, It's Just Withering from Scientific Neglect."

Don't look in Begley's column for detailed understanding of what went on at ICCF10. It is not there, so in some sense this column, though we very much appreciate its appearance at all, in effect does for cold fusion what the columnist is lamenting! Ms. Begley wrote: "What these claims need is critical scrutiny by skeptics. That is how science normally functions. But in Cold Fusion, it isn't. And that's the worst pathology of all." At another point she wrote, "But the real pathology is the breakdown of the normal channels of scientific communication, with no scientists outside the tight-knit cold fusion tribe bothering to scrutinize its claims." Yes, Sharon Begley heroically put her finger on the central conundrum of cold fusion: Experimental data continues to be deliberately ignored by Establishment scientists.

Indeed it is a terrible pathology that scientific papers on cold fusion/low-energy nuclear reactions are rejected outright—*without review*—at publications such as *Science*, *Nature*, and *Physical Review*. But science journalists must also be faulted—not just the obstructing scientists. The community of science journalists should be holding the Establishment's feet to the fire—requiring Establishment mouthpieces to provide *detailed scientific responses* not just bigoted blather—to the on-going, highly successful cold fusion/LENR experiments.

What happened to the "good old days" at *The Wall Street Journal* when veteran science journalist Jerry Bishop (now retired) felt it the duty of science journalism to report the facts—what was reported at a particular conference and "to hell" with what the critics were saying, though these were appropriately given their space in Bishop's exemplary reporting from 1989 through the mid-1990s. I hope that *The Wall Street Journal* wakes up, but don't hold your breath. Bishop had told me before he retired that the *Journal* editors were holding him back from more extensive coverage.

Still, we are grateful that an intelligent reporter, Sharon Begley, attended some of the conference and put her finger on the central problem facing the CF/LENR field. For this, we thank her.

MIT Professor Peter Hagelstein Sends Letter to U.S. Secretary of Energy

Prominent cold fusion researcher Prof. Peter Hagelstein of MIT, who was the Chairman of the Tenth International Conference on Cold Fusion, sent the following letter to the U.S. Secretary of Energy on September 25, 2003:

September 12, 2003

Spencer Abraham
Secretary of Energy
1000 Independence Avenue, SW
United States Department of Energy
Washington, DC 20585

Dear Secretary Abraham,

I noticed with interest a recent column in *The Wall Street Journal* by Sharon Begley last Friday (September 5, 2003). She wrote this column after attending the 10th International Conference on Cold Fusion, which was held recently in Cambridge at the end of August. Her argument in this column was that perhaps most problematic about the conference was not what was presented and discussed at the conference, but the lack of interest on the part of the scientific community.

I write this brief letter to you wearing three hats. First, as a member of the DOE community, having won the 1984 Lawrence Prize for National Defense. Second, as a faculty member at MIT. And third, as Chair of the conference under discussion.

The conference was technically very strong, and has been considered by many to be the best of the ICCF series to date. The evidence for nuclear emissions from metal deuterides in a variety of experiments presented at this conference, and at previous conferences, is very strong. The experimental evidence in support of an excess heat effect that has accumulated over the years is very compelling, certainly strong enough that it should be of interest to DOE and the scientific community in general.

As you know, DOE assembled a panel to review results in this area in 1989. This group, the ERAB panel, was composed of distinguished scientists from different disciplines who were tasked to provide a recommendation to Admiral Watkins about what should be done in the area. Specifically, the ERAB panel was tasked to: (1) review experiments and theory, (2) identify what research should be undertaken to determine what processes might be involved, (3) provide guidance as to research and development directions might lead to understanding and applications.

The ERAB panel was not convinced that there was anything to the claims, based on the information available in 1989 and 1990. Moreover, the panel noted that the claims would be "contrary to all understanding gained of nuclear reactions in the last half century," and would "require the invention of an entirely new nuclear process."

The panel recommended against any special funding for research in this area, and suggested that the funding system present at that time might be used to provide modest support in the area.

Now, more than a decade later, much progress has been made. The relatively weak evidence available in 1989 and 1990 is now superseded by much stronger results, which are sufficient to convince distinguished scientists that are otherwise unbiased. The experimental evidence, in my view, is now beginning to provide some indication as to what new

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physical mechanisms are at work.

I think that it is now time to review this area once more. A great many of my colleagues who work in this area feel the same way. There is a great interest among the public, as indicated by the nearly 200,000 papers on the subject that have been downloaded during the past eleven months from a website devoted to cold fusion.

I propose that you consider the possibility of convening a new review panel to provide an updated recommendation based on the initial tasking provided by Admiral Watkins. I would recommend that new scientists be appointed, as some of the members of the previous panel might be considered to have already made up their minds based on what they have said in public and have published.

I offer you my personal assistance in this matter, and the assistance of many of my colleagues who have studied the new phenomena over the past fourteen years.

Sincerely,

Peter Hagelstein
Associate Professor
Department of Electrical Engineering and Computer Science
Massachusetts Institute of Technology
Chair, ICCF10
E-mail: plh@mit.edu

Concord Monitor Publishes Mallove Question to Presidential Candidates

On September 26, 2003 the *Concord Monitor* newspaper of Concord, New Hampshire published a letter that Dr. Eugene Mallove had been circulating, which was addressed to candidates in the very important New Hampshire Presidential primary election, which takes place in January 2004. Now all the Presidential candidates can be said to have been *asked* to take action. Letters in the *Concord Monitor*, one of New Hampshire's leading newspapers, are very definitely monitored by all the candidate camps. For the record, here is the text of the letter as the Monitor published it:

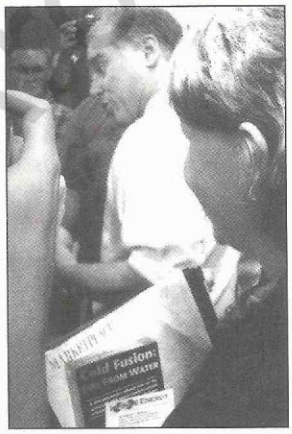
> This will be my question to all presidential candidates that I happen to encounter during the New Hampshire primary season:
>
> I'm Dr. Eugene Mallove of *Infinite Energy* Magazine in Concord. I'd like to ask your position on an issue that transcends and yet encompasses all the other issues that you and other candidates talk about—peace, freedom, the economy, healthcare, the environment, and—of course—energy independence:
>
> During your campaign will you demand a review by the U.S. Department of Energy or by the National Academy of Sciences of the now overwhelming body of scientific evidence that supports cold fusion/low-energy nuclear reactions energy?
>
> This is clean, abundant energy from water, a scientific discovery made in the United States and announced in 1989—and then crushed, as it was being confirmed, by arrogant vested academic and bureaucratic interests.
>
> A Yes or No answer will do!
>
> If anyone wishes to post this question elsewhere, or to ask it himself or herself of any candidate, I would be thrilled. Please let me know if any responses are received from any of the presidential candidates or their senior advisors. We will post responses on our website and elsewhere.
>
> Eugene F. Mallove
> Pembroke (NH)

One could hope that the publication of this "Open Letter" in the *Concord Monitor* would prompt some widespread action by citizens and candidates, but it probably will have little effect.

Encounter with Two Presidential Candidates

In New Hampshire, one can get up close to more than one Presidential candidate in a day or two.

On Friday, September 12, 2003, Dr. Eugene Mallove was a neutral observer in Concord, New Hampshire at a "rally" for Vermont Governor Howard Dean at the Bektash Shrine Center, a non-sectarian charitable fraternal group's place where candidates like Senator Bob Dole relish starting out on their Presidential campaigns. I was there in that very building in 1995 for Dole's New Hampshire coming-out party; I didn't get to speak to Dole then, but I button-holed his colleague, U.S. Senator Grassly of Iowa, to give him the abbreviated cold fusion story. On September 12, Dean was scheduled for a 5:15 p.m. arrival, but came about a half-hour later as the crowd built up. Dean was greeted by a raucous group of an estimated 300-plus. He gave his Bush-bashing (and harshly anti-Iraq war) speech to the howling and cheering Democrats there. It was difficult being one of the only ones in the room not cheering—just studying the man and the audience and waiting for my chance to ask the cold fusion question. There were several young people in the audience wearing blue T-shirts with yellow inscriptions, "Clean Energy." They were touting wind and solar power—and Dean "played" to them in his speech from time to time. He finished abruptly after forty minutes or so. I was very disappointed to find that he was being spirited away, that there was to be no Q&A at the end of his passionate, and at times angry, speech. (His face had visibly reddened with anger at several points—the crowd loved it.)



Presidential hopeful Howard Dean. His aide holds the video "Cold Fusion: Fire from Water" and Sharon Begley's *Wall Street Journal* article on cold fusion.

But as Dean moved slowly through the roiling mass of well-wishers to the exit, I got the attention of one of his top "handlers"—a Ms. Catherine Hess, if I heard the name from her lower-echelon co-worker correctly. I handed Hess two items: our video documentary, "Cold Fusion: Fire from Water" and a copy of the September 5, 2003 *Wall Street Journal* article by Sharon Begley, "Cold Fusion Isn't Dead, It's Just Withering From Scientific Neglect." Hess promised to bring these items to Dean's attention; that's what handlers do, promise, promise, promise—just like their candidates, only handlers can throw the items in the trash and get away with it more easily. Well, at least we're on record that these two items of critical information—which just might perk Dean's attention—were provably delivered. Just as was our 2000 "Memorandum to the White House on Cold Fusion" that was delivered to President Clinton (at his request—

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it is posted at www.infinite-energy.com) and then later to President George W. Bush and to Vice President Dick Cheney—with no perceptible results except "thank you" notes.

With Dean, however, I lucked out and was able to take several digital photos of Ms. Hess holding the copy of the "Cold Fusion: Fire from Water" VHS tape in her arms, the video's colorful box, with title visible, superimposed against candidate Dean's torso as he tried to escape the clawing well-wishers—*proof* of sorts about "what Dean knew and when did he know it" in the matter of cold fusion.

On Sunday night in Manchester, New Hampshire (September 14), I attended a 6:00 p.m. "Town Hall Meeting" with Joe Lieberman at the elegant New Hampshire Institute of Arts and Sciences. The spate of Lieberman meetings in New Hampshire is dubbed by the campaign, "Operation: Liebermania." Despite the name, it was a much more sedate, organized crowd—and seated too, whereas at Dean's rally almost everyone was standing. And Lieberman himself was much less impassioned than Dean—much less "red meat" thrown out to the anti-Bush crowd, mostly Democrats it seemed. The meeting lasted for two hours as Senator Lieberman answered all manner of questions from both well-dressed and craggy-looking street folk. Unfortunately, I had made the mistake of registering as Press, so one of the press-handlers cautioned me as I raised my hand not to ask a question as an ordinary citizen might. She advised me that there would be time after the meeting for a session with reporters. As it turned out, there was no formal session and reporters had to try to shove their tape recorders toward him, as he moved slowly toward the ornate hall's exit, to ask him their questions. This was not deceit, it was disorganization. I followed behind one enterprising reporter who asked Lieberman a sensitive question about the Middle East—generally he was very forthcoming throughout the evening and then. I got my chance, as I squeezed through the people in front of me. Here is a transcription of our brief exchange:

Mallove: Senator, one question. I'm Dr. Gene Mallove from *Infinite Energy* Magazine in Pembroke.

Lieberman: Yes.

Mallove: I know Jeff Woodburn [a Democratic Party of New Hampshire leader and Lieberman supporter who just happens to be renting office space in Pembroke to *Infinite Energy* as of 2003], and I know your fine colleague Dick Swett. [Editor's Note: Dick Swett is the former U.S. Congressman from the N.H. 2nd District in the early 1990s, who helped us get cold fusion scientists included in Congressional Fusion Energy hearings in 1993, to the dismay of the hot fusioneers. He later became U.S. Ambassador to Denmark. And: Lieberman had announced at this Town Meeting that Dick Swett was now his campaign's energy advisor! This fact was unknown to us before this meeting, but we were delighted to learn this.]

Lieberman: Yeah.

Mallove: Dick and I and others have struggled for probably twelve years now to get one single question answered by the U.S. Department of Energy. There was a conference in Cambridge recently on this question of cold fusion energy, which you probably don't know much about. But it turns out that it needs review—the data needs review. There was an outrageous rush-to-judgment in the beginning. Now it needs review. The question is, would you during the course of your campaign as a public service. . .

Lieberman: Yeah. . .

Mallove: . . .which you have been speaking strongly on, energy and innovation. . .

Lieberman: Right, right. . .

Mallove: Would you ask the Department of Energy to re-review the data or the National Academy of Sciences?

Lieberman: What's it about?

Mallove: Well, it was the subject—here—the subject of the *Wall Street Journal* editorial [the Begley essay; Mallove hands Lieberman the copy of the editorial]. Just look at this. . .

Lieberman's Press Aide: I have the tape for you on that, Senator, from *Infinite Energy*; I'll give it to you. [It was given to her by Mallove for the Senator before the Town Meeting began.]

Mallove: All you have to do is look at the tape. . .She has it.

Lieberman: We'll look at it, and we'll get back to you.

Mallove: Fine! You want two? [Mallove hands a second copy of the tape to Lieberman's aide.]

Lieberman: Dick knows about this?

Mallove: Dick knows about everything! Ask him about Gene Mallove in New Hampshire. . .

Lieberman: I will.

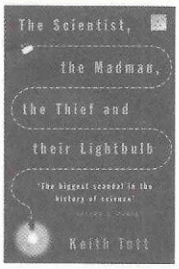
Mallove: Thank you very much.

We'll see where this will lead. Stay tuned. It's up to the candidates, who are being given the information they need by the New Energy Foundation. We hope to get this topic into the public arena so that it becomes a legitimate matter for discussion in the context of all the other energy issues that will be discussed by Presidential (and other) candidates during the campaign. In this way, there is a chance that the DOE will be forced into an embarrassing review of the now overwhelming evidence for cold fusion/LENR energy. That would be the end of the preposterous charade of the last fourteen-plus years against one of the greatest scientific discoveries in history—one that may be critical to our future.

Any help that other citizens may be able to render toward this goal would be much appreciated.

The Scientist, the Madman, the Thief, and Their Lightbulb

by Keith Tutt



This is the U.S. release of the book originally titled *The Search for Free Energy*. Tutt presents the many new energy/free energy inventors of the past 100 years, from Nikola Tesla, to Stanley Pons and Martin Fleischmann, to Randell Mills and Alexandra and Paulo Correa; the book includes two chapters on the cold fusion field and its researchers.

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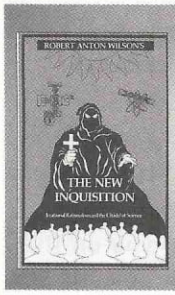

The New Inquisition:

Irrational Rationalism and the Citadel of Science

by Robert Anton Wilson
ISBN 1-56184-002-5
$14.95 Paperback, 240 pp.
New Falcon Publications, 1986

Review by Jon Norris

The idea that science is a near-perfect process that is automatically self-correcting and always produces the best possible result, while still adhered to by some, has long been shown by careful study to be a completely false notion. Science, being a human endeavor, is subject to all the same errors to which all other human endeavors fall prey. Greed, ego, corruption, hatred, and even stupidity are just as prevalent in the hallowed halls and ivory towers of science as anywhere else on (or off) the planet. In fact, the belief that science somehow filters out all these things is simply one more major source of error.

That said, science has proven very useful in many ways. Its usefulness is dependent, however, on the integrity of the process. There have been many investigations of this process, and indeed the ethical aspects of science is a branch of ethics all its own. Some very good work in this area has been done by Thomas Kuhn, Paul Feyerabend, Richard Milton, Hans Ruesch, William Broad, and Nicholas Wade. While not a new work, Robert Anton Wilson's *The New Inquisition* adds the unique perspective and insight of one of America's great iconoclasts to this list.

Many will be familiar with Wilson's other works, such as the *Illuminatus Trilogy*, *Prometheus Rising*, *Cosmic Trigger*, and *Wilhelm Reich in Hell*. Wilson's writings are always penetrating, insightful, and quirky. You cannot read Wilson without having new thoughts. This alone would be enough to recommend his work, even if it did not contain powerful arguments and hard data.

In the spirit of serious intellectual discourse, he begins by defining terms and investigating the impact of language and culture on our perceptions. This is necessary to clarify the ways in which our mental and linguistic filters color our ability to accurately model our reality. Wilson draws from such diverse sources as Aristotle, Fuller, Hume, Gödel, Kline, and Schrödinger, to weave a potent fabric of logical argument exposing what he sees as the major flaws of the scientific process. He dips into anomalous and "impossible" data to provide radical intellectual counterpoint designed to shake one loose from the dusty ruts of mainstream thought.

And just what does he see as those major flaws? The primary problem Wilson addresses is what he refers to as Fundamentalist Materialism or the New Idolatry. While he is quite comfortable with empirical methods and materialism within their limitations, Fundamentalist Materialism by definition involves an inability to remain open to changes in models and paradigms, which Wilson compares to religious fundamentalism. He describes in some detail the process and nature of mental stagnation that leads to this irrational state. His logic is persuasive:

> There remains, of course, Scientific Method (SM), the alleged source of the certitude of those I call the New Idolators. SM is a mixture of SD (sense data: usually aided by instruments to refine the senses) with the old Greek PR. Unfortunately, while SM is powerfully effective, and seems to most of us the best method yet devised by mankind, it is made up of two elements which we have already seen are fallible—SD (sense data) and PR (pure reason) can both deceive us. Again: two fallibilities do not add up to one infallibility. Scientific generalizations which have lasted a long time have a *high probability*, perhaps the highest probability of any generalizations, but it is only Idolatry which claims none of them will ever again have to be revised or rejected. Too many have been revised or rejected in this century alone.
>
> *Certitude is seized by some minds, not because there is any philosophical justification for it, but because such minds have an emotional need for certitude.* (Wilson's italics)

Wilson presents a mental exercise to which he returns periodically throughout the book, illustrating how one's perceptions change with additional data. He proposes twenty-one statements, such as "Water boils at 100 degrees Celcius," "Ronald Reagan wrote Hamlet," "Beethoven is a better composer than Mozart," and "Colorless green ideas sleep furiously." By examining these twenty-one ideas in various ways, he demonstrates how context, language, emotional preferences, and preconception color our understanding and creation of models and paradigms.

Wilson also brings his considerable wit to bear on the problem. In discussing the irrational bookburning behavior of Fundamental Materialists, he states: "In such a state, we appear 'beyond reason—*i.e.* beyond the normal parameters of social discourse. The only places for us, then, are in a quiet and restful home in the country, surrounded by kindly doctors, or in the Vatican, or in the Committee for Scientific Investigation of Claims of the Paranormal."

There is more to this book than I can examine in this short space. The book is packed with references to more detailed works, strong arguments, and paradigm-challenging travels through Wilson's eclectic knowledge base. I find him to be one of the most important thinkers alive today, and I heartily recommend his works. Anyone concerned with the place of science in our world today, or interested in freeing one's thought processes from dusty paradigms, should include a healthy portion of Wilson's books in their reading. This book is entertaining, thought-provoking, and well worth your time. ❐❐❐

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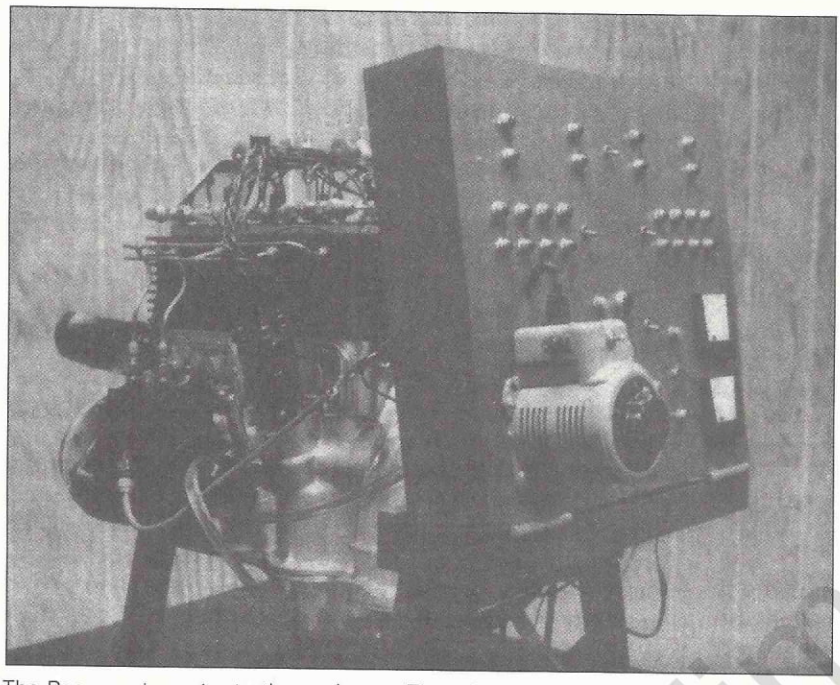
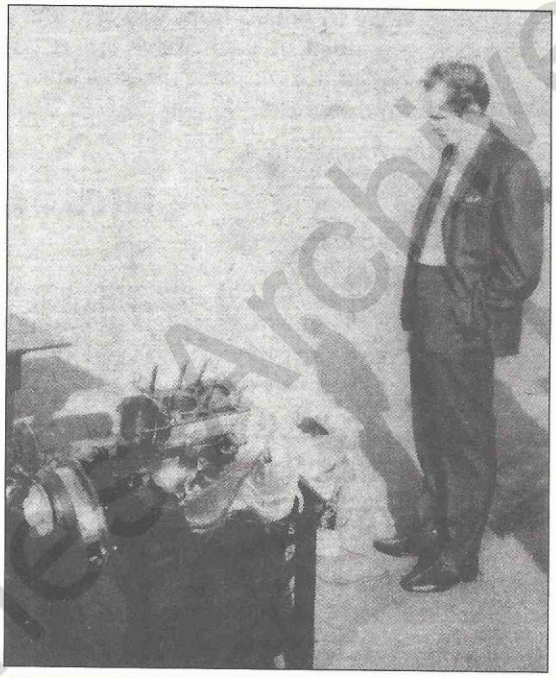
The Papp Saga Continues. . .

Eugene F. Mallove



The Papp engine prior to the explosion. This photo is taken from a September 16, 1968 article in *Industrial News*, entitled, "Firm Promises to Tell What Makes Its No-Heat, No-Exhaust Engine Go." The caption reads: "This is the Papp engine. In front is an analyzer board. All components have been double wired, enabling the board to pinpoint malfunctions."



Moments after the explosion, a distraught, bewildered Joseph Papp stares at his ruined engine. Firm's attorney Milton Golden says Environetics still has "great faith in the project." [Photo and caption are from the November 25, 1968 *Industrial News* article reprinted at the end of this piece.]

Since our seminal coverage of Joseph Papp's noble gas engine in *Infinite Energy* #51, new information has come to light about the history of the engine—in particular, about the lethal explosion of the first working Papp engine at a public demonstration in Gardena, California on November 18, 1968. Thanks to the fine cooperation of Marie Crimi Roser, wife of the late Don Roser (the businessman who had initially worked with Joseph Papp), we are able to present this potpourri of news reports, photographs, and other remnants from 1968. They give an immediacy to those astonishing times and allow us to experience them as never before.

Explosion in Engine Kills 1 Man

News Pilot (San Pedro, California), November 19, 1968

GARDENA (AP)—An unidentified observer at the test running of an experimental automobile engine apparently caused the explosion that killed one man and injured eight others, deputies say.

The observer pulled the engine's control wires loose at the control panel, officers said. That let the pressure build up in the front cylinder, causing the blast.

John Edward Hartman, 40, of Torrance, an engineer with Mattel, Inc., was killed when a chunk of the engine was driven into his abdomen.

Deputies say they are seeking the observer—one of 35 present—for questioning.

The blast occurred Monday afternoon in the south parking lot of Environetics, Inc.

Officers said the engine's inventor, Joseph Papp, 35, had removed the wires himself to show a skeptic in the crowd of onlookers that the engine was not operating on outside power.

He quickly reconnected them but the observer removed them again shortly before the explosion, officers said.

. . . . . .

***IE* Editor's Comment:** The "unidentified observer" to which the article refers was none other than physics Nobel laureate Prof. Richard Feynman of Caltech. Marie Roser provided this written comment about the article: "The reason some reports say that Papp pulled the plug and others say that Feynman pulled the plug: They are both right. Papp disconnected the plug when Feynman challenged him, but when he plugged it back in Feynman pulled the plug again and then the blast occurred." That is a very interesting observation by Mrs. Roser, but the exact sequence of events may remain uncertain, unless television footage of the event (which might still exist!—some news reports refer to a TV cameraman who was present) is ever located.

Marie Roser provided a valuable photocopy of a letter on Environetics, Inc. letterhead from Don Roser to the Los Angeles County Sheriff, a letter dated the day of the explo-

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sion. Here is the text of that brief note:

Los Angeles County Sheriff
Los Angeles, California
Re: Report Number Y-624573

Gentlemen:

This will authorize attorney Chester B. Shapiro or his representative to obtain from you any and all information contained in your above report concerning the accident that took place on November 18, 1968 on the above premises.

Very truly yours,
ENVIRONETICS, Inc.
Don Roser
Chief Executive Officer

Chester B. Shapiro was the attorney representing Environetics. He is now deceased, according to Mrs. Roser. Now that we have the actual sheriff's report number, it may be possible to obtain this original report.

Witness Sought in Area Blast

Gardena • Hawthorne • Lawndale Advertiser (Daily Breeze Publishing Co., Torrance, California), November 21, 1968

Sheriff's detectives are attempting to locate a man who is supposed to have disconnected an experimental engine Monday moments before it exploded, killing one man and injuring at least eight others.

The explosion occurred at 2:10 p.m. at Environetics, Inc., 15821 S. Broadway, in county territory near Gardena.

A spokesman at the sheriff's office said there is no criminal charge pending against the unidentified man, but that they would like to question him—if he can be found.

Sheriff's investigators said criminal negligence apparently was not a factor in the explosion of the experimental automobile engine.

Joseph Papp, 35, the inventor of the experimental engine, said the man unplugged the engine from the power source after accusing him (Papp) of perpetuating a hoax.

Moments after Papp reconnected the engine to the power source, the engine exploded.

Dead from injuries suffered in the explosion was Jack Hartman, 40, of 3837 231st Place, Torrance.

Hartman was attending the demonstration as a representative of Mattel Toys of Hawthorne.

Injured in the explosion were eight other persons. Three persons were admitted to Memorial Hospital of Gardena, but hospital officials said that one of the injured had been released Tuesday.

Robert C. Bogert, 49, of 5439 Round Meadows Drive, Hidden Hills, was released. Remaining in the hospital in fair condition are Harold M. Childers, 48, of 8812 Anchorage Drive, Huntington Beach, and Joe J. Quagletti, 52, of 511 Via del Monte, Palos Verdes Estates.

. . . . . .

***IE* Editor's Comment:** This article, appearing three days after the accident, may offer a new insight into the actions of Richard Feynman. Whether deliberately or inadvertently, Feynman had not made himself available to the police after the accident, or at least had not identified himself to them—or, it would seem, to Joseph Papp either.

Experimental Engine Explodes; 1 Dead; 8 Hurt

Gardena Valley News and Gardena Tribune (Gardena, California), November 21, 1968

***IE* Editor's Comment:** This is the top banner headline (above the newspaper masthead) for a series of articles which appeared in this issue of *Gardena Valley News*. Marie Roser sent us an original copy of this 62-page newspaper, which provided massive coverage of the Papp engine explosion on the Monday preceding publication. This newspaper was then published, according to its header, only on Thursday and Saturday, so this issue would have been the first coverage of the explosion by the newspaper.

There are the two major stories on the explosion. The primary story has the headline: "Black Monday Blast Kills Father of Six at Scene of Horror." Following the first front page story by reporter Johnny O'Donnell, the ex-Marine gives us his personal thoughts as an eye-witness to the tragedy, in the story "First Day on New Job Recalls War-Training." It was his first day on the job as a reporter—what a way to begin! Though for some this account may be almost too graphic to consume, it is a valuable documentation of the devastating power of the Papp engine explosion. If this was not the product of surreptitiously planted conventional explosives—Feynman's later imagined interpretation of the "hoax"—the evident high velocity of the fragments and their wide dispersion testify to the immense power of a new source of energy.

Both stories are reprinted in full below. Italics indicate sections which were bold-faced by the original source. Bracketed notes are those of *Infinite Energy*.

Black Monday Blast Kills Father of Six at Scene of Horror

by Johnny O'Donnell

Death paid a visit to Gardena at approximately 2:30 p.m. Monday afternoon when an experimental engine being demonstrated by inventor Joseph Papp suddenly exploded at the Environetics, Inc. plant at 15821 S. Broadway. It killed one man, injured eight. . .and shook up a lot of onlooking people who had been invited to the demonstration by Papp, who miraculously escaped injury himself.

Don Roesser [Roser], the financial backer of the experiment, also escaped injury as an onlooker.

Less fortunate was the dead man, John Edward Hartman, 40, of 3887 231st Pl., Torrance, a representative of the Mattel Toy Co. of Hawthorne who had been invited to the test. He is survived by his widow Eileen and six children, Susan, Steven, Cheryl, Pamela, Terri, and Mark.

Three other observers were seriously injured and four were treated for cuts and bruises.

County fire crews, sheriff's deputies and McCormack Ambulances arrived approximately 10 to 15 minutes after the explosion. The ambulance attendants made several runs and reacted commendably according to most onlookers.

"Hot" Check

Sheriff's deputies and firemen sealed off the area and checked

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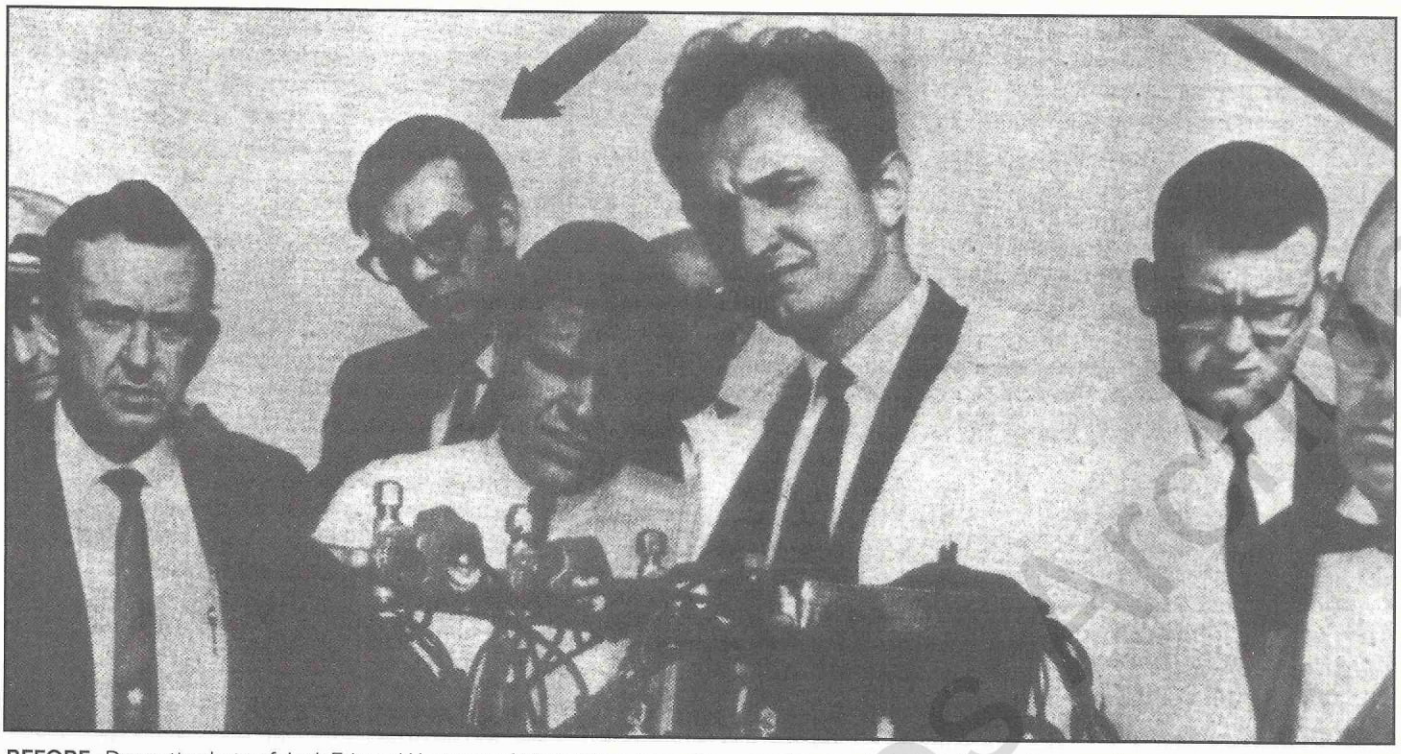


BEFORE—Dramatic photo of Jack Edward Hartman of Mattel Toys (arrow) snapped moments before his death caused by the exploding engine, was taken by staffer Ken Huthmaker. The deceased man was not immediately recognized later because his glasses had been knocked off by the impact of the exploding fragmented engine. A closer look at the faces almost ironically seems to foreshadow the impending tragedy. Inventor of the new secret expanding gas formula, Joseph Papp, stands directly behind the Papp Engine, a modified 90 horsepower Volvo engine. He wears a white laboratory coat. (All photos are courtesy of *Gardena Valley News*, Photographer Ken Huthmaker.)

it for radioactive contamination but found none present.

Listed in fair condition at the Memorial Hospital of Gardena was Harold M. Childers, 48, of 8812 Anchorage Drive, Huntington Beach. Childers was representing TRW Systems of Redondo Beach. His leg, which was badly mutilated, according to onlookers, "will be saved," said Gardena Hospital's Dr. Sydney Booth Tuesday afternoon.

Robert C. Bogert, 49, of 5439 Round Meadows Drive, Hidden Hills, was admitted with "foreign bodies in his scalp," hospital people said. Onlookers say Childers [Bogert, not Childers] reacted with remarkable coolness when he was hit by metallic flack in the skull.

He even took his own pulse rate at the scene while injured and bleeding profusely. He is in satisfactory condition and is associated with North American Rockwell Co.

Also in fair condition at the Memorial Hospital of Gardena was Joe J. Quagletti, 52, of 511 Via del Monte, Palos Verdes Estates. He suffered a partial amputation of his shoulder but his arm has been saved, according to Dr. Sydney Booth. He is a representative of Industrial Realty Co.

Treated for a heart attack after most of the activity had ended was Los Angeles resident John Y. Takaguchi, 67, of 1035 Dewey Avenue.

Treated for cuts and bruises and subsequently released were: Del Linam, 36, TV cameraman for KHJ-TV, who was miraculously saved from death by his camera. It caught the impact of a piece of flying metal which would have torn through his skull, had it not hit the camera. Linam had been hit slightly in the leg.

Bobbie J. Keyes, 39, of 10602 Lesterford Ave., Downey, also was treated. Mr. Keyes is a representative of B and H Piano Movers and was a non-involved onlooker.

Others slightly injured were Jerry J. Halton, 66, of 99 Skyline Drive, Burbank, who was with Halton Associates; and newspaperman John P. O'Donnell, who was covering the event for the *Gardena Valley News*. O'Donnell was hit in the head.

According to Papp: "The motor had been running for about 10 minutes when someone came up to me and accused me of perpetrating a hoax." The gentleman thus mentioned was Mr. Feynman of Caltech, who according to eyewitnesses pointed out to the inventor that his machine was hooked up to an electric cable. The inventor exhibited anger, and disconnected the cable.

At that point, according to eyewitness accounts, Feynman asked the inventor to let him hold the cable and asked Papp to wait and see if the motor would still run. The inventor refused, and reconnected the cable to the socket. At that instant the engine blew up. Pieces of metal and shrapnel flew into the air and bombarded the crowd.

According to eyewitnesses and those injured, no safety provisions were afforded the spectators who had been invited to view the demonstration.

Mr. Papp, the inventor, wore a safety crash helmet, but none was offered to the crowd of onlookers. It was implied earlier in a film shown to the group that the gases being demonstrated were extremely powerful and in fact blew a cannon in half instead of powering out the cannon's projectile.

According to those injured, as well as those present, the demonstration "was handled in an extremely non-professional and amateurish manner." Members of the press and private industry expressed the opinion that "the whole mess might have been avoided if safety factors were observed and proper planning and precautions followed for the demonstration."

New Energy Times Archive

One observer was heard to say, as he tried to clean blood off his hands, that "this whole blankety-blank mess should never have happened. It indicates that those people who claimed to be knowledgeable were in fact ignorant of the danger factors in playing with such gases."

Ex-Marine Eye-witness: First Day on New Job Recalls War-Training

by Johnny O'Donnell

Today I journeyed into the valley of death.

Once again, old reaper, thy shadow did not fall upon me. Thank you, Oh Lord, my cup runneth over.

Blam!

Bodies were sprawled upon the gore-splattered asphalt that was now reddened by flowing blood.

For a brief moment in time. . .the whole world stopped. It was a millisecond after the engine exploded. "My God," I thought, "the damn experimental engine blew up. They've really done it. . .my God, that guy has a four inch hole in his gut."

Scene of Shock

Shocked faces were everywhere as some of us reacted like the trained soldier or Marine we may have been. Head down, peppered by metal fragments, we raced toward the wounded. I shouted to a guy standing there to "give me your handkerchief." He snapped out of it, as we both went into motion.

I was tearing my jacket off, as a third man rolled his into a ball. The guy I yelled at gave me his handkerchief. "What the hell can I do with this anyway?" I thought.

I bent over and began untying the shoelaces of the man whose blood splattered my hands. "Oh God," I thought, "don't let him die. . .I just talked to him a few moments ago. . .he's a nice guy, God, and young."

As a jacket was placed under his head, I opened his trousers and his blood pumped onto my hands. I wasn't thinking. I was reacting like a guy in a dream—somewhere else. . .maybe the land of unreality. Forget it. This was happening. But it wasn't Korea or Vietnam. It was a parking lot in Gardena.

"The blasted engine." . . .I opened the shirt around the wound. . ."that stupid engine". . .his intestines were coming out. The blood in the wound gurgled with popping air bubbles. "He's alive. . .thanks, God. . .he's alive. . .my God, it's the guy from the toy company. . ."

The other guy told me to give him artificial respiration. "Help me," I yelled back. The wounded man was sucking wind through his opened mouth. The other guy fell to his knees, next to his head. I held his head, then cleaned the wounded man's lips. The other guy began to give him the kiss of life. . .artificial respiration through the mouth.

The wounded man turned yellow. . .his bloodied chest heaved as air bubbles snapped through the blackened blood of his gaping wound. "Oh my God. . .don't let him die. He's here. . .the reaper is here. . .this man is dying," I thought, "Please God, don't let him die."

"Hurry Those Ambulances"

Someone else took over, relieved me from holding his head. I ran toward the other man who was down. His leg was hanging off from the shin. "Good God," I thought, "I can only give aid. . .I can't repair. . .dammit. . .please hurry those ambulances."

I ran to the highway cop at the gate. . ."Open the gate," I told him. . .He stood inside with me. We were all locked in. "Boost me over the damn thing. . .wake up man. . .people are dying in here."

The poor guy couldn't do anything, either. We had to wait a couple of minutes to get the gate opened. Everyone was yelling. Metal fragments were all over the place.

"That blasted engine," I thought. "It's killed some of us." I didn't know how many.

"The hell with the gate," I thought as I ran back to the other wounded men. One had a hole in his head. I asked him his name. Two fellows assisted him.

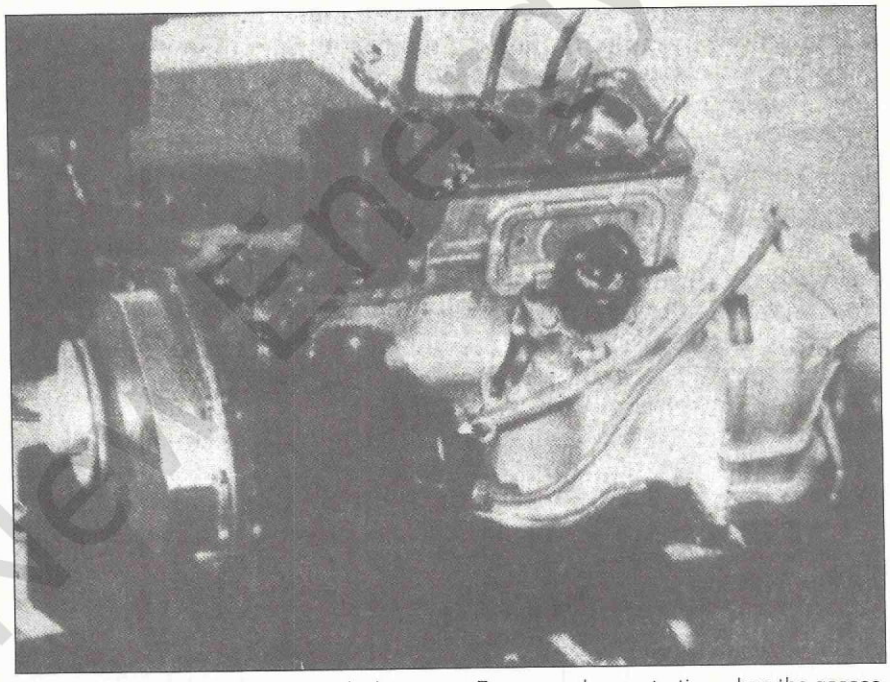
"I'm okay," he winked as he continued to take his own pulse rate. "What a cool one," I thought. "A marvelous guy. I bet he's okay. . .I hope so." I winked back at him and squeezed his hand, he winked again. I jumped back to the others. I yelled at one guy to put a tourniquet on the man who had been torn open at the shoulder by shrapnel from the "blasted engine." His arm was hanging loose.

"I've got a tourniquet on him," he snapped back. Our eyes met, and I could see that he was as mad as I about the frustration of the whole blasted thing.

"Blast that engine. . .Blast it anyway," I thought. . ."and where the hell are those ambulances?" I yelled at some employee standing there with egg on his face. He ran inside, to the phone. I think. . .

"Angel of Mercy"

By this time, the others who weren't hit



AFTER—This is the Volvo engine which inventor Papp was demonstrating when the gasses therein expanded and blew up. The engine is normally capable of 90 horsepower and was exceeding 300 horsepower when it blew up. Each cylinder contained a unit of "expanding gases" according to Environetics chief Ron [Don] Roesser [Roser].

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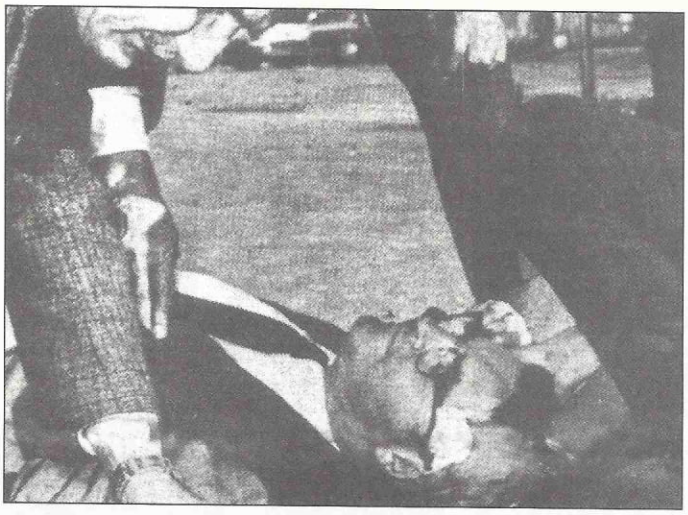

HEAD INJURY—Robert C. Bogert, 49, of 5439 Round Meadows Drive, Hidden Hills, lies wounded with a skull injury. Expanding gasses evidently reacted to a second electrical charge administered by inventor Papp when he plugged in the electrical cable. The engine which had been "whining down" according to witnesses, exploded, spraying the crowd.

HEART ATTACK—County fireman administers emergency oxygen to heart attack victim John Y. Takiguchi, 67, of 1035 Dewey Ave., Los Angeles. Photographer Ken Huthmaker had taken this photo as one of the last dramatic series snapped during a day that had begun as a routine photo assignment day. Takiguchi was treated and released later from the hospital. He is listed as being in satisfactory condition.

were trying as lamely as I to do whatever we could to aid the downed. The smell of death and blood had triggered our animal being. Some of us were functioning like well-oiled clocks. I dropped to the side of the guy with the hole in his stomach and held his head. . ."Look out," I yelled. . .The angel of mercy who had been applying life-giving air to the toy man looked up at me. There was blood on his lips. I had felt a spasm coming through the body of the wounded man. Pieces of him came up through his throat and we tried to clear his mouth. We did.

The other guy. I never did get his name, he reapplied his lips and with bent head and aching back, began breathing life into the man who was turning yellow. The wounded man stiffened. The "angel" stopped. We both stopped. Looking at each other. . .praying in a glance that he wouldn't die.

He didn't. . .not just then. He heaved and began to suck in air again.

I thought, "Thank God. He lives." I felt better. I ran to the other wounded again, mopped their blood, tried to be chipper, held one guy's hand.

I asked dumb questions just to keep them talking and conscious. One guy told me he lived in Palos Verdes, another that his arm was O.K. It was like Hell.

His face was ashen and beads of perspiration covered his brow. His buddy adjusted and opened the tourniquet and took care of him like his own brother. He may have been. The guy whose leg hung off below the knee couldn't feel it. He was magnificent.

Wink from the Wounded

I ran then to the guy with the hole in his head. He winked, "Hi, again" at me and smiled. My God, I thought, what a man.

The first ambulance came. . .we yelled for the attendant to load the man with the hole in his stomach first. They did. They then lifted my new friend, the guy with the hole in his head, onto a stretcher. The black blood poured from the wound behind his ear. . ."My God, don't let him die," I breathed.

I don't know what happened next, I was reacting and doing what I was trained to do when I was a kid in the Marines. It had been 11 years since I wore that uniform, but thank God for that training. Thank God for the sweat and cramped muscles. It was all paying off now.

I stopped Del Linam, the news cameraman from KHJ-TV. He was something else. Shrapnel had hit his camera, denting it, and his leg had been hit in the knee. Del was bleeding but tending to the downed and shooting film all at the same time.

"Slow down, amigo," I yelled at him. He stopped, smiled, and shook his head.

The time was over. The harried time. The time when men act and react to the smell of blood and death. I felt sick. So did Del. We both had jobs to do. We were newsmen. He limped away toward his car to drive off to the hospital. All of the downed men were gone now. . .whisked away in relays to the hospital.

Heart Attack

An elderly Japanese gentleman was having a heart attack. I helped another guy to a chair. . .He was from Caltech and his name was Feynman.

The Japanese gentleman was a Mr. John Takiguchi. . .One man, a late arriving fireman, administered oxygen.

They were all too late, I thought. The damage has been done. No one can rectify that damned moment in time. Blam! Then motion, activity, action, blood, yelling, confusion, cursing, frustration and tears inside all.

Men who had been invited to this "Press Demonstration" stood shaking their heads. . .we all felt the same way. . .angry and thankful and tired. . .very tired.

A few minutes later, I found myself back inside of my jacket. . .I do not remember putting it on. I was holding a notebook and talking with an Oriental fellow who was trying to assist the man having the heart attack. Police, sheriff's and fire department people milled around. I looked at the blood all over the asphalt.

Empty Shoes

I no longer felt sick. Just tired. Then I saw the empty shoes that I had taken off the man from the toy company. . .he was a nice guy. . .a young guy.

My publisher arrived, I told him what happened. He told me that the guy with the belly wound was "D.O.A" at the hospital. . ." dead

New Energy Times Archive

GEIGER COUNTER—County fireman checks a metal piece of the exploded Volvo engine with a Geiger counter. Since the company said that it was an "atomic" engine, this was a precautionary tactic to check the area for possible radioactive contamination. Fortunately, the Geiger counter registered normal and it was later learned that no radioactive gasses or materials were used in the engine being demonstrated on Monday.

INVENTOR—Joseph Papp, Hungarian-Canadian inventor of the "secret" formula gas used in the Volvo experimental engine which exploded Monday mirrors the tragedy in his face during aftermath. Papp earlier had been wearing a laboratory white jacket and a safety helmet. Sheriff's deputy reconstructs scene.

BULLETPROOF MAN—Gerald J. Halton, Burbank public relations man, miraculously escaped death Monday when a bolt from the exploded engine cut through this sheath of papers he was cradling in his arm in front of his chest. Halton suffered lacerations directly over his heart.

on arrival." I looked at the empty shoes again. . .my heart dropped.

I walked over to a nearby platform and kicked a box, then I kicked it again, harder. Some guy from one of the dailies arrived bright-eyed and bushy-tailed and asked me for information about what had happened!

I shot facts at him through a veil of sadness that had walled me inside my mind.

"Those blankety-blank benefactors of humanity, with this blankety-blank engine."

Then I thought, don't curse 'em baby. . .pray for them. That's all I can do. I bent over to pick up my glasses and someone told me I was bleeding and that I was hit slightly on top of my head.

"Big Deal," I thought. My tears and mind were on the toymaker. . .the man whose leg hung off. . .the man whose arm was torn open. . .the man with the huge hole in his head. . .the Japanese gentleman, and the cameraman with the bloodied knee. Then the questions began by deputy sheriffs, firemen, and other reporters. I couldn't find my glasses. The sheriff's deputy and one of the employees told me that they loaded them onto the ambulance because they found them next to the guy with the hole in his stomach. His name was Jack E. Hartman. . .I looked again at the card he had given me earlier. . .he worked for Mattel Toy Company and he was director of preliminary design. "Dammit," I thought.

"Through Hell Together"

Bill Hunt, my new boss said, "C'mon John, let's go to the hospital. . .we'll get your glasses and have your head looked at." I went along with him to my car. I bumped into Mr. Feynman from Caltech again. . .we shook hands. . .like comrades who had been through hell together. We had.

He asked me if I knew where the nearest bar was. He said, "I need a stiff drink."

I was embarrassed that I couldn't direct him. It was my first day on the job, and I didn't know the town that well, yet.

My boss and I dumped ourselves into my Cougar, and I drove to the hospital, as Bill directed me. "How do you feel?" he asked. "Okay," I lied, touched by his warm concern.

We didn't talk much on the way there. We pulled up and I met the four ambulance attendants who worked like beavers that day. . .they handed me my glasses. I went into the emergency doors. . .feeling sad. . .thinking of a dead toymaker. A pretty nurse took my name and told me that the man with the hole in his head would live. I mentally leaped with joy.

They asked me routine questions. . .and I gave them the answers. Name. . .address. . .nature of injury. . .did I have hospitalization?

First Day on Job

"No. . ." I told them, ". . .it's my first day on a new job." They stopped and looked at me and said, "what a first day, huh?" I tried hard to smile.

"Yes," I said, "It was quite a first day."

A routine assignment to cover the experimental brainstorm of someone to to make a buck. . .and people blown all over a Gardena lot that is now covered with the blood of eight men.

My boss stood nearby watching me. I knew he was looking for a reaction. "Too bad he can't see inside me," I thought. I went down the hall and the intern asked me more questions and looked at the tiny notch in my balding noggin.

"Give him a tetanus shot," he told the nurse. She did. We smiled and exchanged courtesies. I was still in a bit of a fog.

New Energy Times Archive

ON THE JOB—His first day on the job was literally a baptism of blood for new *Gardena Valley News* staff writer Johnny O'Donnell, whose introduction to *GVN* readers may be found below. Here he is pictured after the confusion following the explosion of an experimental engine at a local plant, which resulted in the death of one man and serious injury to four others. O'Donnell, questioning two employees of the company, had just glanced up to tell a television cameraman: "Don't take my picture, take the picture of the guy in the chair, he's having a heart attack right now."

I looked around and there on a portable bed was my friend with the hole in his skull. He gave me a big grin and I shook his hand. "Thank you, God." I thought, "This one will live."

The others were all cut and banged up, but the doctors could fix that.

I thought of the dead toymaker. I felt lousy. I walked down the immaculate hospital corridor toward the cafeteria where I sat with my boss and had a cup of coffee. "Quite a day, John," he said. "Quite a day," I agreed.

We drove back to the office in silence. . .I broke it occasionally, but I don't remember what I said. I was thinking about a dead toymaker, a lousy safety factor, a world of sometimes grim reality and a world of hope. I thought of the man with the hole in his head smiling up at me.

I went to my typewriter back at the office, and I began once again. . .to try to tell it like it is. It was my very first day on the job in a new town, a place for which I now have a kindred feeling. A town where I received a baptism of blood as I left tears and part of my soul upon the blackened pavement of a parking lot, next to a building where an old friend, the grim reaper, wet his blade once again.

He missed me again. His sharpened scythe just touched me slightly, reminding me that "One never knows. . .does one?" Once again I remembered a prayer. . .I don't know it by heart. It is a psalm. . .the twenty-third, I believe, and as I began typing my story I thought, "Surely goodness and mercy will follow me, now, all the days of my life. . .and I will dwell in the house of the Lord, forever."

. . . . . .

***IE* Editor's Comment:** A number of photos accompany these news stories, some under the banner "Pictures tell story of Black Monday, day of horror. At press-time, company spokesmen declined comment on Monday disaster."

The "After" photo (see p. 52) is most interesting. It appears as though the entire cylinder head assembly, which has "cooling fins" in the "Before" photo, has been violently lifted off and its retaining bolts have been sheared and bent toward what looks like the forward direction of the engine (the portion that had held the cooling fan, which is no longer there—probably destroyed). Since there was definite evidence of fragmentation of the engine cylinder head—judged by the wide dispersal of the injuries in the crowd of onlookers—it seems reasonable to conclude that the point(s) of origin of the explosive release was within those retrofit combustion cylinders, or at least within one of them. It would have been difficult for a "hoaxer" to place explosives in the cylinder head of an engine, have that engine operating with piston motion within the cylinders, and then arrange via circuitry to have the explosives go off at will. Furthermore, the explosion (whatever its explanation) provably occurred in a completely unplanned way after the intervention by Nobel laureate Feynman. Finally, is it reasonable to imagine that Papp would deliberately detonate "illicit explosives" in the midst of a crowd of onlookers, risking injury and death? Feynman's hoax theory is a very long stretch. *Infinite Energy* will now attempt to obtain copies of the original photos of the post-accident scene debris, and the official accident report itself, to learn if further insights are possible.

The following short quip was printed near the two photos, "Inventor" and "Bullet Proof Man": "Speaking of Mickey Mouse": Minutes before the tragic explosion Monday, *GVN* staff member Johnny O'Donnell was standing beside Jack Edward Hartman of Mattel Toys. O'Donnell commented on what he called the "Mickey Mouse manner" in which the demonstration was handled. Hartman responded by presenting staffer O'Donnell with his business card and the information: "Speaking of Mickey Mouse, I'm Jack Hartman of Mattel Toys." Minutes later he was dead.

The Anatomy of a Tragedy

Industrial News, November 25, 1968
by Larry Liebman

He was squeamish but also very prophetic.

When the Papp engine began its ten minute demonstration last Monday at Environetics in Gardena, my technical advisor, who is a mechanical engineer with rocket experience, stood well out of the way, behind the protection of a building.

"Come back," I called. "You're not watching the demonstration."

"The engine is going. . .that's all I want to know," he answered. "I've seen too many of these experimental things explode."

I laughed. . .but as I was calling him chicken I was also edging toward where he was standing.

This was a preview of an engine which was said to emit no exhaust, use no air, use no heat and run on a self-contained fuel source that could last for 60,000 miles of driving. My technical advisor was along to either confirm or deny its authenticity.

SRI Was Expecting It

On Tuesday morning, the Papp engine was to have been delivered to the Stanford Institute for dynamometer performance tests.

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The test started. Hungarian-born Joseph Papp, the engine's inventor, knelt down to operate a control board which was attached by cable to the engine which was about 100 feet away.

Sometime between the seventh and eighth minute of the ten minute test, Papp was approached by a man in a tan sweater. I saw them exchange a few words. Papp seemed irritated. He unplugged the cable and seconds later reconnected it.

During the eighth minute of the ten minute test the Papp engine exploded.

In the instant after that brief but loud report I looked at my technical advisor, whose grin seemed to convey "I told you so." Several others were also grinning.

But the grins vanished with the cry of: "Some men are hurt."

Luckily, the gathering was peopled by imperturbably administrative types who methodically went about administering help.

But there's a limit to methodical help. One man lay dying with a massive shrapnel would in his stomach. Mouth-to-mouth respiration was to no avail.

Two others are now hospitalized—one is in danger of losing a leg, another of losing an arm.

Five others received minor wounds and were released. A cameraman from channel nine was saved because at the time of the explosion he was peering into this camera and about to roll some film. Shrapnel struck his camera.

Another man was holding some brochures and magazines against his chest. A bolt from the engine penetrated his reading matter but stopped just short of this chest. If not for the magazines he would have been pierced through the heart.

Roser Went North

At presstime Thursday, Don Roser, Environetics chief executive officer, was at Stanford discussing the prospects of continuing with the proposed tests.

It should be remembered that the machine can be built up again. It has been disassembled in the past.

A four cylinder, 90-hp Volvo automobile engine was the basis for the rig. But only the short block was used. The cylinder head, intake and exhaust valve and accessories were discarded.

Whether a new Papp engine will still employ a Volvo bloc is undetermined.

"Everything is hanging on the results of an investigation into the cause of the explosion," said Environetics attorney Milton M. Golden. "But, I can assure you the company still has great faith in the project."

Sheriff's officers gave this explanation of the explosion:

Papp disconnected the wiring running from the control board to the engine after a skeptic suggested that electrical wiring running from the control board was supplying power to operate the engine.

Papp started to hand the plug to the skeptic and then suddenly had second thoughts and yanked the plug back and reconnected it. Seconds later pressure built up in the front cylinder of the modified Volvo engine causing the explosion.

The skeptic (the man in the tan sweater) turned out to be Caltech theoretical physics professor Richard Feynman. He attended the demonstration after hearing about the engine's purported marvels from his students.

Caltech Prof's Account

Feynman gave this account of what happened:

"While Papp was kneeling operating the control board I came up to him and said: 'How do I know that this cable isn't carrying the energy that makes this motor go?'

"Then Papp unplugged the cable. I said, 'Give me the plug.' I touched the plug briefly but he took it back from me. After reinserting the plug I heard him mutter the word 'recharge.' Then came the explosion. Afterwards Papp turned to me in anger and hurled his hard hat to the ground.

"The incident left myself and others with a number of disturbing questions.

"Why did Papp allow himself to be distracted?

"Why was Papp the lone person wearing a hard hat?

"Why was the crowd told to stand about 100 feet from the engine?

"In the data sheet handed out before the test the engine was referred to as an atomic powered engine. I and others at the scene immediately feared that we had been exposed to radiation. Yet, the fire department's geiger counter study turned up no evidence of radiation."

Why the Demonstration?

Why did Environetics choose to hold a demonstration one day before the engine was to be shipped to the Stanford Research Institute for tests?

A favorable report by an organization as reputable as SRI would have won far more converts than an inconclusive ten minute demonstration.

"This tragedy should serve as a lesson for all industry," said my angry technical advisor.

"The fact that we were told to stand back showed that there was some fear of explosion. The major aerospace firms conduct such tests in concrete cells. Those watching the demonstrations are never in the direct line of fire. They watch the test through mirrors—or through some other such safe arrangement."

The engineer was also angered by the fact that Papp—the man conducting the test—should respond to a skeptic's challenge.

"The man at the controls should always have absolute authority," the engineer said.

Ran for 8 Minutes

Obscured, if not forgotten in the aftermath of the explosion, was the fact that the engine did run successfully for eight minutes.

My technical advisor, who tests engine concepts for a major aerospace firm, said that "there did seem to be some element of legitimacy to the claims made about the engine."

"According to Papp's explanation, the gas is ionized. Its molecular structure is rearranged by discharging the capacitor," my advisor said. "That gives the expansion to drive the cylinder."

But he added this disclaimer: "The briefing before the demonstration was far too brief. . .and without having had the chance to tear the engine apart I can't make any positive endorsement."

Still unexplained was the exact composition of these "readily obtainable gasses" which were supposedly capable of lasting for 60,000 miles of driving.

Caltech's Feynman was still firmly skeptical.

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"During the test a man came up to Papp with an air meter [ammeter] and asked if he could measure the juice going through the cable," Feynman said. "But Papp said no."

"Also the cable running to the engine could have supplied power in many ways. Everything was just too obscure and too much was left unanswered."

Later, after pondering the merits and demerits of the Papp engine, I pondered my own safety.

Where would I have been standing if I hadn't heed the warning of an experienced rocket engineer?

. . . . . .

***IE* Editor's Comment:** This a remarkable article, which appeared in this industrially-focussed local area newspaper just one week after the Papp engine explosion in Gardena. It confirms that Stanford Research Institute was to have tested the engine on November 19, 1968, the day after the public demonstration that ended in tragedy. It also confirms that the engine ran for almost ten minutes before the explosion—actually eight minutes, according to the author, who was present that day. The anonymous mechanical engineer, who fortuitously had advised the author about safety during the demonstration, was evidently experienced in rocket engine technology and related safety issues. That Papp alone had donned safety gear clearly confirms his own fears about the hazards of the technology—given what had transpired in an explosive test of one cylinder of the engine the previous month. He evidently felt that asking others to move back 100 feet from the engine provided sufficient safety for them. But would it make sense that he would try to protect himself *near* the engine *only with a hard hat* from an explosion of the engine with implanted illicit explosives—as Feynman later would suggest was the mode of his "hoax"— to forestall being "found out" at SRI? That would have been a very big risk for even Papp to take! We are left with the haunting words of the technical observer: ". . .there did seem to be some element of legitimacy to the claims made about the engine."

Pre-Explosion Photo, From a More Innocent Time—In late September 2003, Marie Roser kindly sent a color photocopy of a color photograph of Joseph Papp, herself (then Marie Manto), and Don Roser, dated August 8, 1968. The three are kneeling in front of what Marie says is the "first Papp engine." What looks like an engine control panel with at least two affixed electrical gauges and a voltage-regulating variac is to the right of the engine proper. The engine itself appears to be in a paneled room at Environetics, resting on a metal cradle or platform. Marie noted: "The engine was running in our conference room many times. We would not have risked our lives if we had any idea it could explode."

The Papp Energy System

by Don Roser, Chief Executive Officer, Environetics, Inc.

The Papp engine will undoubtedly be recorded as one of the most significant breakthroughs of this century. With scientists now alerted to the inexorable forces of air pollution, irreversible atmospheric free oxygen despoilation and the toxic effects of carbon oxides, a frantic quest is underway to find an abundant, cheap substitute for fossil fuels. Billions of dollars have been spent to research and develop solutions to these pressing worldwide problems. It is now widely held that the potential toll in human life and suffering, resulting from these crises, rivals and indeed surpasses the imminent problems of overpopulation facing the sociologists.

It is providential that the Papp energy system concepts were conceived and developed by an individual rather than by the team effort of a government or industrial giant whose unlimited funds and personnel already have begun to conquer space.

Team efforts in many fields of technology, working together in synergical concept for a common goal, have advanced the "state of the art" in the fastest possible time. However, the "goal" must first be defined and the sphere of activity uniformly investigated with proper deployment of the investigative effort. This manifests a logical process of deductive reasoning. It has proved a most efficient system of inquiring into known fields of endeavor.

It is fact that most radical discoveries of significant magnitude are the result of individual encounter, acting independently of the group effort. It may be an accidental confrontation of an individual with a phenomenon of nature, or a true meeting expectant of psychological receptiveness and a truth exposed. The occurrence of these exigencies are too infrequent to ponder. When revolutionary discoveries such as the Papp engine are reviewed with pragmatic acceptance by visionaries, then the groundwork is laid for the development of a new tool, potentially useful to mankind in his unending quest to master his environment. $E=mc^2$ is an equation familiar to most schoolboys. It was one of the mathematical concepts which led to the birth of a new awesome force of nature, which if unleashed could have tragic effects on civilization. This is atomic fission energy, an energy that is difficult to control and make available in small quantities. It creates dangerous radioactivity.

Scientists now theorize that thermonuclear fusion is much more powerful and yields much less toxic radiation than the fission process (*e.g.*, the "clean" H Bomb).

Joseph Papp has developed a practical, workable system to blend fusion energy in small quantum, with the laser principals of light forces and thus harness the energy resultant in an engine device wherein the power pulses are cycled with

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the precision required to transform the power of the atom to direct mechanical energy bypassing the parameters of the thermodynamic cycle governing the function of the heat engine now extant. This is *plasma physics*. Papp reaches beyond abstract theory to the reality of an engine 100 years in advance of its time. . .yet it is not too soon.

A principle of the Papp engine is basic and simple: A hermetic gas chamber is created by the telescopic fitting of two cylindrical units each open at one end, when fitted one over the other to permit extension and retraction of the unit under the cycling pulses of a varying gas pressure confined within the chamber. The gases are estimated to have a life cycle of 6,000 hours operation time, with Papp guaranteeing 1,000 hours. The gases, which are relatively inexpensive, abundant and harmless, are charged into the piston chambers and subjected to controlled electrical pulse and radiation effects, thereby expanding with great force, then contracting, on signal, ready to repeat the cycle for the life of the system.

Since the atomic engine is not aspirated and yields no exhaust it may be operated submerged in water, or in the far reaches of space uniquely unaffected by its extraneous environment. Because the atomic energy released is limitless, the horsepower attainable is boundless. For example, a 4 cylinder 2 cycle engine so constructed with a total of 20 cubic inches displacement will yield 400 HP and up, as desired.

We suggest the Papp engine does presage a new era of work performance capability and ushers in a new field for scientific investigation.

. . . . . .

***IE* Editor's Comment:** Don Roser's sincere commentary was provided to us by Marie Crimi Roser. It appears to be his assessment of the Papp engine technology as it stood in the late 1960s. It was to-the-point and eloquently prophetic about the nature of other discoveries in the new energy field that would come years later, not from government labs, but from individuals acting independently: "It is fact that most radical discoveries of significant magnitude are the result of individual encounter, acting independently of the group effort. It may be an accidental confrontation of an individual with a phenomenon of nature, or a true meeting expectant of psychological receptiveness and a truth exposed."

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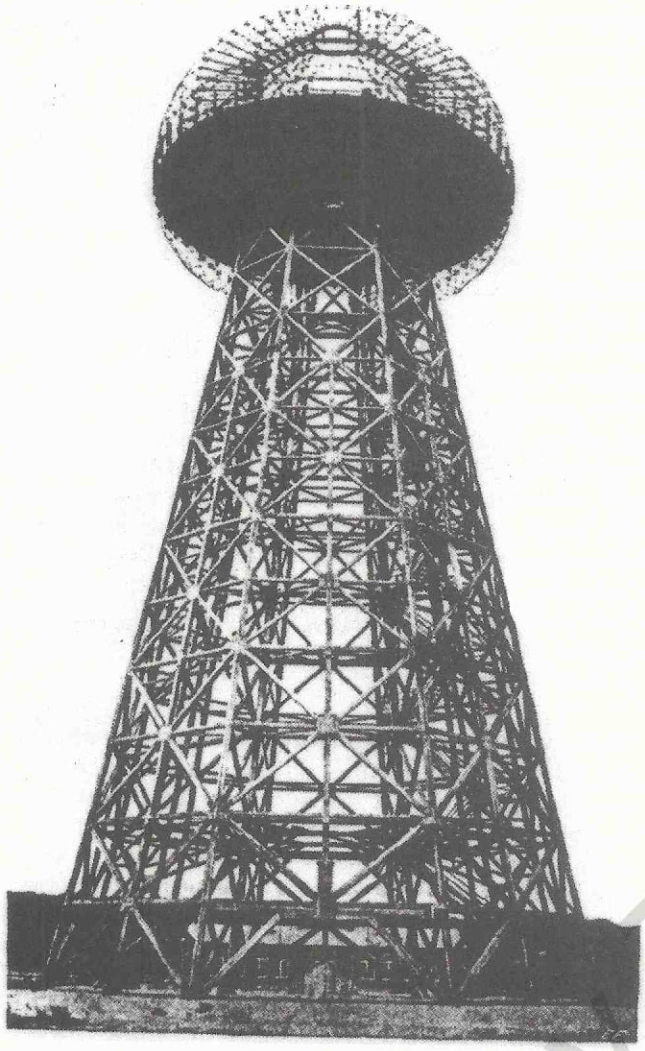
RECONSIDERING

Tesla's Wireless Energy:

Ionospheric Energy Utilization May Relieve Electricity Transmission Gridlock

Thomas F. Valone*



The 187-foot Wardenclyffe Tower in 1903; it stood unfinished for the next fourteen years. The two-story power plant, by comparison, is in the background.

Overview

This summary article is presented in recognition of the Wardenclyffe Tower Centennial (1903-2003), a monument to Nikola Tesla's visionary genius. Excerpts are taken from the new book, *Harnessing the Wheelwork of Nature: Tesla's Science of Energy*, which contains several papers from prominent physicists detailing the unusual method of pulsing a broadband Tesla coil at a repetition rate of 8 Hz to resonate with the Earth's Schumann cavity.[1] Nikola Tesla, the father of AC electricity, is responsible for recognizing that an atmospheric and a terrestrial storage battery already exists everywhere on earth, for the benefit of mankind. This is perhaps the "wheelwork of nature" that Tesla was referring to.[2] A century later, only a handful of visionary scientists recognize the untapped renewable reservoir of *terawatts of electrical power* that sits dormant above us, waiting to be utilized.

Background

In 2001, the Bush-mandated National Transmission Grid Study (NTGS 2001) was designed to identify the major transmission bottlenecks across the U.S. and identify technical and economic issues resulting from these transmission constraints. With deregulation of our nation's utilities and the lack of jurisdiction for the Federal Energy Regulatory Commission (FERC), the U.S. is fighting an electrical energy crisis which, right now, costs consumers hundreds of millions of dollars annually due to interregional transmission congestion. There is no longer any economic incentive nor any FERC eminent domain for states to provide rights-of-way, besides the lack of Federal compensation to utilities to build new transmission lines.

Historically, the creation of electrical utilities was beset with scandal, such as the six years of Congressional hearings starting in 1928 in which "thousands of pages of testimony revealed a systematic, covert attempt to shape opinion in favor of private utilities, in which half truths and at times outright lies presented municipal systems in a consistently bad light."[3] Today, U.S. AID funds the U.S. Energy Association to train utility representatives from the former Russian states on how to reliably monitor electricity usage and collect money from customers in their respective countries, while those economically challenged people struggle for sufficient wages.

At a Washington D.C. conference which this author attended, called "Implementing a National Energy Strategy: Breaking Down the Barriers," also sponsored by the U.S. Energy Association (12/01), only the depressing news about unresolved U.S. electricity headaches were discussed. Editor of *Energy Daily*, Llewelyn King finally concluded, "We are using nineteenth century technology for electrical transmission." He then called for a paradigm shift toward new technology and cited the "monster infrastructure problems" within the U.S. as compared to developing countries. A year later (June 2003) the U.S. DOE held an emergency meeting with utility heads as a natural gas crisis looms from the lack of diversification of new electrical power generation facilities. "Innovation in new technology and renewable sources are needed in the long term to improve the environment and meet rising demand," summarized an *Investors Business Daily* editor about the crisis.[4]

In November 2002, the American Council for the United Nations University called for *wireless energy transmission* to circumvent the need for transmission lines as part of their "Millennium Project." In cooperation with the National Science Foundation (NSF), NASA, and the Electrical Power Research Institute (EPRI), the beaming of microwave energy and the creation of a world energy organization was seen to actively address the 2020 challenges to global electricity supply, especially

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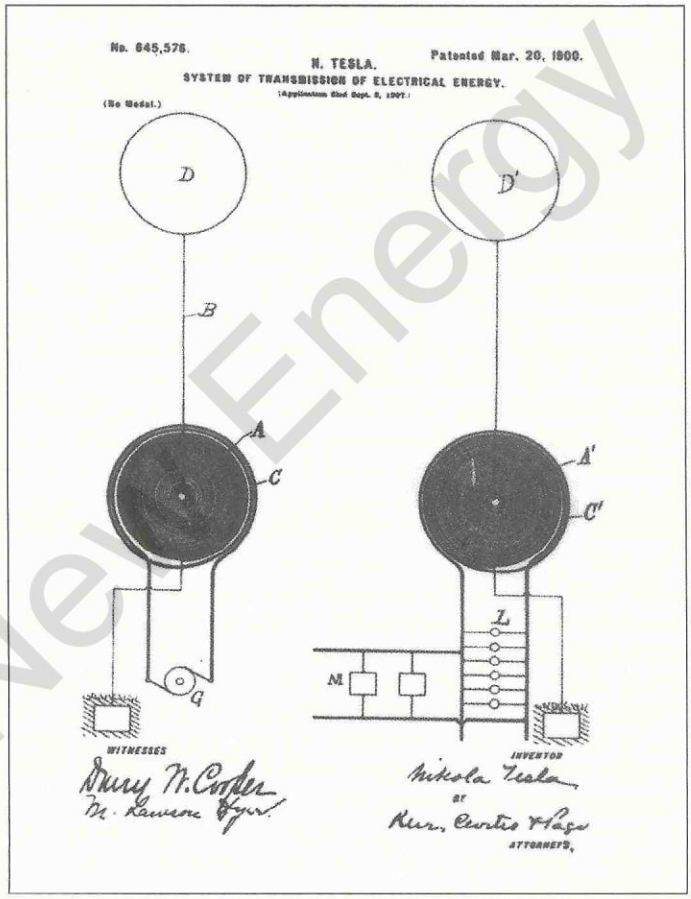
in areas of massive urban concentrations.[5]

In 1940, "the United States prided itself on using half the world's electricity."[6] Since 1980, the U.S. has also doubled its dependence on foreign oil and *doubled* its electrical transmission grid inefficiency. From 31 Quads (quadrillion BTUs) generated, a full 2/3 is *totally wasted* in "conversion losses" with only about 11 Quads (3.7 trillion kWh) delivered to the end-user.[7] Instead of trying to build two power plants per week (at 300 MW each) for the next twenty years (only to have a total of additional 6 trillion kWh available by 2020), as the Bush-Cheney Administration wants to do, we simply need to *eliminate the 7 trillion kWh of conversion losses* in our present electricity generation modality.

History of Tesla's Wireless Energy

The fateful decision in 1905 by J.P. Morgan to abandon Tesla's Wardenclyffe Tower project on Long Island (after investing $150,000) was a result of learning that it would be designed mainly for *wireless transmission of electrical power*, rather than telegraphy. No more money was forthcoming for the project that Morgan initiated, even when the equipment alone cost about $200,000. Morgan believed that he would "have nothing to sell except antennas (and refused) to contribute to that charity."[8] Tesla tried and tried for years until in 1917 the U.S. government blew up the abandoned Wardenclyffe tower because suspected German spies were seen "lurking" around it. With Edison as his willing ally, Morgan even publicly discredited Tesla's name, so that all of the five school textbook publishers of the time removed any reference to him. Any wonder why even today, 100 years later, hardly anyone knows who Tesla is?



The rest of this article will present a physics and electrical engineering argument for a subsequently forgotten engineering alternative for energy generation and transmission.

As Tesla experimented with a 1.5 MW system in 1899 at Colorado Springs, he was amazed to find that pulses of electricity he sent out passed across the entire globe *returned with "undiminished strength."* He said, "It was a result so unbelievable that the revelation at first almost stunned me."[9] This verified the tremendous efficiency of his peculiar method of pumping current into a spherical ball to charge it up before discharging it as a pulse of electrical energy, *a "longitudinal" acoustic-type of compression wave*, rather than an electromagnetic Hertzian-type of transverse wave. It was, therefore, more akin to electrostatic discharge than wave mechanics.

Tesla also planned to include a *stationary resonant wave* creation globally, within the earth-ionosphere cavity, as part of the wireless transmission of power. Examining the pair of 1900 patents #645,576 and #649,621 (each using the same figure on the first page), we find in the first patent that Tesla has designed a quarter-wave antenna (50 miles of secondary coil wire for a 200 mile long wavelength). More importantly is the sphere on the top, which is supposed to be a conductive surface on a balloon raised high enough to be radiating in "rarefied air."[10]

As Tesla states:

> That communication without wires to any point of the globe is practical with such apparatus would need no demonstration, but through a discovery which I made I obtained absolute certainty. Popularly explained it is exactly this: When we raise the voice and hear an echo in reply, we know that the sound of the voice must have reached a distant wall, or boundary, and must have been reflected from the same. Exactly as the sound, so an electrical wave is reflected, and the same evidence which is afforded by an echo is offered by an electrical phenomena known as a "stationary" wave—that is, a wave with fixed nodal and ventral regions. Instead of sending sound vibrations toward a distant wall, I have sent electrical vibrations toward the remote boundaries of the earth, and instead of the wall, the earth has replied. In place of an echo, I have obtained a stationary electrical wave, a wave reflected from afar.[11]

Nikola Tesla's discovery of pulsed propagation of energy does not resemble the standard transverse electromagnetic waves so familiar to electrical engineers everywhere. Many engineers and physicists have dismissed Tesla's wireless energy transmission as unscientific without examining the unusual characteristics and benefits of longitudinal waves, which are the z-component solutions of Maxwell equations.

Tesla wrote that "electrical energy can be economically transmitted without wires to any terrestrial distance, I have unmistakably established in numerous observations, experiments and measurements, qualitative and quantitative. These have demonstrated that it is practicable to distribute power from a central plant in unlimited amounts, with a loss not exceeding a small fraction of one per cent in the transmission, even to the greatest distance, twelve thousand miles —to the opposite end of the globe."[12]

Tesla was an electrical genius who revolutionized our world with AC power in a way that DC power could never have accomplished, since the resistance of any transmission

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lines, (except perhaps, superconductive ones), is *prohibitive* for direct current. He deserved much better treatment from the tycoons of his age than to spend the last forty years of his life in abject poverty. However, he was too much of a gentleman to hold a grudge. Instead, regarding the magnifying transmitter, Tesla wrote in his autobiography, "I am unwilling to accord to some small-minded and jealous individuals the satisfaction of having thwarted my efforts. These men are to me nothing more than microbes of a nasty disease. My project was retarded by laws of nature. *The world was not prepared for it. It was too far ahead of time. But the same laws will prevail in the end and make it a triumphal success.*"[13]

Tesla's World System

Tesla's "World System" was conceptually based on three inventions of his:

1. *The Tesla Transformer* (Tesla coil)
2. *The Magnifying Transmitter* (transformer adapted to excite the earth)
3. *The Wireless System* (efficient transmission of electrical energy without wires)

Tesla states, "The first World System power plant can be put in operation in nine months. With this power plant it will be practicable to attain electrical activities up to 10 million horsepower (7.5 billion watts), and it is designed to serve for as many technical achievements as are possible without due expense."[14] Tesla's calculated power levels are conservatively estimated and recently updated with contemporary physics calculations by Dr. Elizabeth Rauscher. For example, Professor Rauscher shows that the earth's ionosphere and magnetosphere contains sufficient potential power, *at least three billion kilowatts* (three terawatts) respectively, so that the resonant excitation of the earth-ionosphere cavity can reasonably be expected to increase the amplitude of natural "Schumann" frequencies, facilitating the capture of useful electrical power. Tesla knew that the earth could be treated as one big spherical conductor and the ionosphere as another bigger spherical conductor, so that together they have parallel plates and, thus, comprise a "spherical capacitor."[15] Rauscher calculates the capacitance to be about 15,000 microfarads for the complete earth-ionosphere cavity capacitor. In 1952, W.O. Schumann predicted the "self-oscillations" of the conducting sphere of the earth, surrounded by an air layer and ionosphere, without knowing that Tesla had found the earth's fundamental frequency fifty years earlier.[16]

Second of two diagrams by engineer J.B. Flowers in 1925 which illustrates the usefulness of Tesla's wireless power transmission.

"All that is necessary," says Dr. James Corum, is that Tesla's transmitter power and carrier frequency be capable of round-the-world propagation." In fact, Tesla (in the *L.A. Times*, December 1904) stated, "With my transmitter I actually sent electrical vibrations around the world and received them again, and I then went on to develop my machinery." Dr. Corum notes in an article on the ELF (extremely low frequency) oscillator of Tesla's that the tuned circuit of Tesla's magnifying transmitter was the whole earth-ionosphere cavity.[17]

Corum explains that a mechanical analog of the lumped circuit Tesla coil is an easier model for engineers to understand.[18] From a mechanical engineering viewpoint, the "magnifying factor" can be successfully applied to such a circuit. "The circuit is limited only by the circuit resistance. At resonance, the current through the circuit rises until the voltage across the resistance is equal to the source voltage. This circuit was a source of deep frustration to Edison because voltmeter readings taken around the loop did not obey Kirchoff's laws!" As a result, Edison claimed such a circuit was only good for electrocution chairs.

Earth's Renewable Energy

Tesla's world system activates the earth's renewable electrical storage battery which normally sits dormant except during lightning strikes. Regarding simply the electrostatic energy storage capacity of the ionosphere, Dr. Oleg Jefimenko, author of *Electrostatic Motors*, explains that during one electric storm, the atmospheric electric field dissipates at least 0.2 terawatts (billion kilowatts), indicating that the entire earth must have even more total available energy.[19]

Furthermore, the power loss experienced by Tesla's pulsed, electrostatic discharge mode of propagation was less than 5% over 25,000 miles. Dr. Van Voorhies states, ". . .path losses are 0.25 dB/Mm at 10 Hz," which often is difficult for engineers to believe, who are used to transverse waves, a resistive medium, and line-of-sight propagation modes that can dissipate 10 dB/km at 5 MHz.[20] The *capacitive dome* of the Wardenclyffe Tower, like the conductive balloon of Tesla's '576 patent, is a key to the understanding of the longitudinal waves. Dr. Rauscher quotes Tesla: "Later he compared it to a Van de Graaff generator. He also explained the purpose of Wardenclyffe. . . '*one does not need to be an expert to understand that a device of this kind is not a producer of electricity like a dynamo, but merely a receiver or collector with amplifying qualities.*'"[21]

Only a few great physicists like Drs. Elizabeth Rauscher, James Corum, and Konstantin Meyl,[22] have realized that Tesla was very practical when he proposed the resonant generation and wireless transmission of useful electrical power. Tesla's knowledge of atmospheric electricity transduction was so extensive and reliable that Jim Corum, who has been

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funded to continue Tesla's work, recently told me, "You just have to do exactly what Telsa did and you will consistently get the same results he did."[23] After returning from his experiments at Colorado Springs in 1900, Nikola Tesla stated, *"If we use fuel to get our power, we are living on our capital and exhausting it rapidly. This method is barbarous and wantonly wasteful and will have to be stopped in the interest of coming generations."*[24] In view of our present fossil-fuel-caused global warming, Tesla seems very prophetic from his vantage point of a century ago.

High Transmission Integrity and Low Loss

Tesla states, "As to the transmission of power through space, that is a project which I considered absolutely certain of success long since. Years ago I was in the position to transmit wireless power to any distance without limit other than that imposed by the physical dimensions of the globe. In my system it makes no difference what the distance is. The efficiency of the transmission can be as high as 96 or 97 per cent, and there are practically no losses except such as are inevitable in the running of the machinery. *When there is no receiver there is no energy consumption anywhere. When the receiver is put on, it draws power. That is the exact opposite of the Hertz-wave system.* In that case, if you have a plant of 1,000 horsepower (750 kW), it is radiating all the time whether the energy is received or not; but in my system no power is lost. When there are no receivers, the plant consumes only a few horsepower necessary to maintain the vibration; it runs idle, as the Edison plant when the lamps and motors are shut off."[25]

These amazing facts are explained by the Corums and Spainol, ". . .the distinction between Tesla's system and 'Hertzian' waves is to be clearly understood. Tesla, and others of his day, used the term 'Hertzian waves' to describe what we call today, energy transfer by wireless transverse electromagnetic (TEM) radiation. . .no one wants to stand in front of a high power radar antenna. For these, E and H are *in phase*, the power flow is a 'real' quantity (as opposed to reactive power), and the surface integral of E x H (Poynting vector) is nonzero. The case is not so simple in an unloaded power system, an RF transformer with a tuned secondary, or with a cavity resonator. In these situations, the fields are in phase quadrature, the circulating power is reactive and the average Poynting flux is zero—*unless a load is applied*. They deliver no power without a resistive load. These are clearly the power systems which Tesla created. The polyphase power distribution system was created by him in the 1880s and inaugurated at Niagara Falls in 1895. The RF transformer was invented and patented by him in the 1890s. Terrestrial resonances he experimentally discovered at the turn of the century. And, for the next forty years he tried to bring through to commercial reality this global power system. Today, millions of us have working scale models of it in our kitchens, while the larger version sits idle."[26] Note for a spherical, electrostatic pulse discharge, E is radial and H is helical since *J is radial* (longitudinal or irrotational current).[27]

Biological and Economic Impact

Another common criticism of the Tesla wireless power system is regarding its possible biological effects. Calculating the circulating reactive power, the Corums and Spainol find a density of a *microVAR per cubic meter* at 7.8 Hz, which is quite small, while it is well-known that such a frequency is very biologically compatible.[28] The authors also look at the present 100 V/m earth-ionosphere field and again find that raising it by a factor of four to ten will pose no ill effects. (Thunderstorms do it all of the time around the world.)

In terms of economic theory, many countries will benefit from this service. Only private, dispersed receiving stations will be needed. Just like television and radio, a single resonant energy receiver is required, which may eventually be built into appliances, so no power cord will be necessary! Just think: monthly electric utility bills from old-fashioned, fossil-fueled, lossy electrified wire-grid delivery services will be optional, much like "cable TV" is today. In the twenty-first century, "Direct TV" is the rage, which is an exact parallel of Tesla's "Direct Electricity."

Let us fulfill this prophesy of Tesla, making it a *triumphal success*, by supporting a philanthropic, international wireless power station installed on a remote island to electrify the whole world. The benefits, immediately making direct electricity available everywhere, are too numerous to count. (Coincidentally, in Tesla's homeland, the Electric Power Company of Serbia raised their monthly rates by 50% on the day *Harnessing the Wheelwork of Nature* was sent to the publisher, while California is now up to 15 cents per kWh, double the nation's average.)

Become educated about Tesla's wireless energy transmission discovery at http://users.erols.com/iri/tesla.htm and help celebrate the Wardenclyffe Tower Centennial at the Tesla Energy Science Conference, November 8-9, 2003 (www.IntegrityResearchInstitute.org).

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About the Author

Dr. Valone received his Master's in Physics from the State University of New York at Buffalo (1984) and his Ph.D. in General Engineering from Kennedy-Western University (2003). He taught physics, AC electricity, microprocessors, and environmental science at Erie Community College (1982-1987), and is the author of several books and about 100 articles and reports. Presently, Dr. Valone is President of Integrity Research Institute, a non-profit organization dedicated to energy research and public education.

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A philanthropic, international wireless power station may be installed on a remote island soon, sponsored by two independent corporations, to electrify third world countries which, equipped with inexpensive receivers, will be able to tune in for "free energy." The economic benefits, immediately making direct electricity available anywhere, are too numerous to count. Make an effort to become educated about Tesla's wireless energy transmission discovery and thereby help celebrate the Wardenclyffe Tower Centennial (1903-2003).

Editor's Comment: Tom Valone presents an interesting and useful review of Tesla's proposals for wireless power transmission, in relation to technological and social events occurring in the era in which the great scientist expounded them. From Tesla's experimental work alone, there appears to be little doubt that power can be transmitted over considerable distances. Whether this could be successful over large regions is another question altogether, but certainly it should be explored and critiqued—much as the beaming of microwave energy from solar power satellites to electricity-producing rectifying antenna arrays on the ground was considered in the 1970s and beyond. My personal perspective on this is that it would be much better to concentrate scientific resources on truly distributed power generation, via tapping the vacuum state, in already proved devices such as the Correa Pulsed Abnormal Glow Discharge reactors (PAGD™), or other such aether-tapping apparatus that may be developed by others. There is also the possibility that the present efforts of BlackLight Power Corporation to create "hydrino" (shrunken hydrogen) power sources, or the efforts within the LENR field might lead to such distributed power. Given the sorry record of government and corporate manipulation of the physical grid, I do not have much faith that an "ionospheric grid" would fare better, but I could be wrong. I believe that compact, personally controlled power sources for truly distributed power will be developed within the next decade. The science is already there to do so. "All that is lacking"—Hah!—are the financial resources to do so. But perhaps some philanthropists will be inspired by the atmospheric approach advocated by Tom Valone. Good luck! —*EFM*

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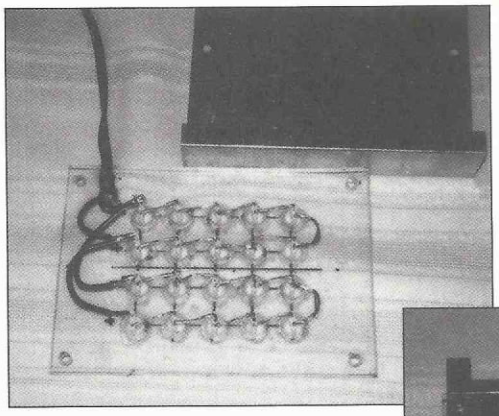
Assembly Instructions for an SB-20 LED Light Fixture

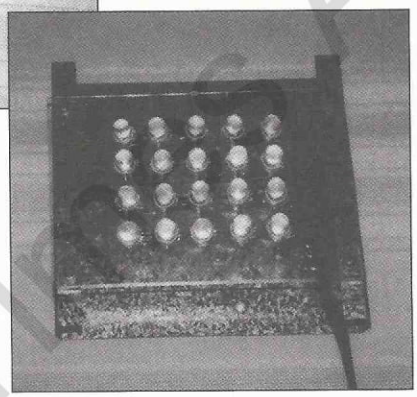
Gary Magratten*

Introduction

The Sunbrite-20 LED light fixture provides adequate task lighting for a work station. The construction costs are low enough to provide a cost competitive light fixture. Reduced power consumption at 7.2 watts and a long working life (ten years) complements the 220 candela of illumination. The basic wiring schematic based on ten LEDs can be expanded to twenty, thirty, or forty LED panels. The 120 volt AC unit lends itself to the existing retrofit market for reduced power consumption. Please see California's PG&E incentive program to assist customers to install energy efficient equipment/products in their homes and businesses. The 12 volt DC unit lends itself to photovoltaic systems where reduced power consumption results in a reduction in the design criteria for the required number of solar panels and battery bank size.



The SB-20 LED light fixture before complete assembly.



The completed SB-20 LED light fixture.

Assembly

Below are the step by step assembly instructions. Please refer to the working drawings and materials list.

1. The 1/4" thick plexiglass base (4.5" x 6") is layed out for 3/8" holes to receive the LEDs. The layout grid as seen in the working drawings is centered on the base with a 3/4" x 3/4" pattern.

2. Check the leads of the LEDs for positive and negative orientation with a small 12 volt battery. *Important*: Reversing the LED direction can make a lot of extra work.

3. Glue the LEDs into the 3/8" holes in the plexiglass base. Make sure the positive/negative orientation is correct. Use clear model cement. Allow the cement to dry.

4. Lift the positive and negative leads of the LEDs into a horizontal position. Place a #18 hard copper wire approximately 1" long between the positive and negative leads. Solder the leads and the hard copper connections together.

5. Drill four small 1/16" holes to receive the bridge rectifier. Solder the two direct current leads of the bridge rectifier to #16 stranded copper wire with insulation. Connect the hard copper leads of the LEDs to the stranded copper wire of the bridge rectifier. Connect the two AC leads of the LEDs of the bridge rectifier to a 12" white and black stranded copper wire with insulation, 14 gauge. (It may be necessary to connect a ground wire from the metal enclosure to the ground of a three wire 120 AC house circuit.)

6. The reflective sheet metal enclosure can be fabricated in a few minutes at a sheet metal shop. See the working drawings (metal enclosure).

7. Drill four 3/16" holes in the four corners of the plexiglass base for a bolted connection to the sheet metal enclosure. Use four 6-32 x 3/4" long bolts with nut and washers.

8. Drill two 3/16" holes for wood screw connection from the sheet metal enclosure to structural framing. Use two 1.5" wood screws to hang the light fixture.

9. Connect the rough 120 volt AC wiring to the light fixture with two

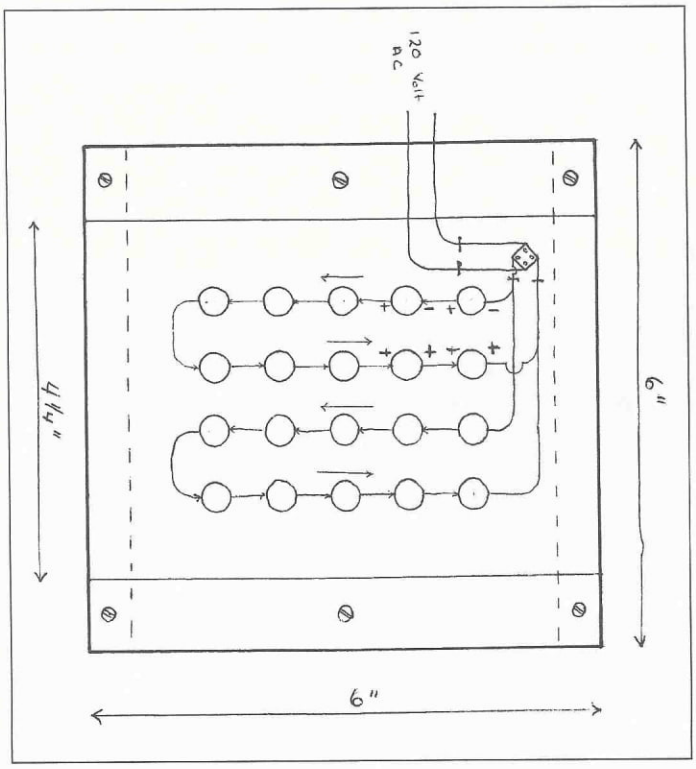


Figure 1. A working drawing of the SB-20 LED light fixture, 120 volts AC.

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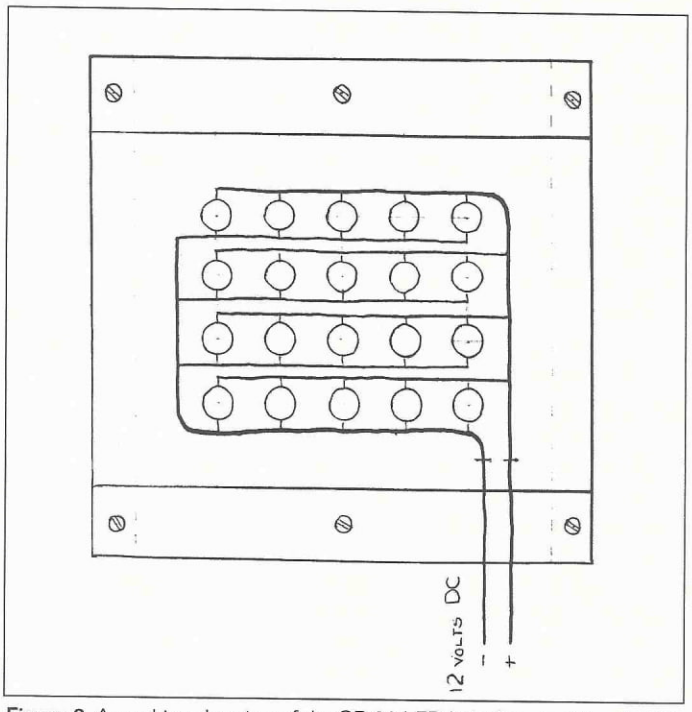

Figure 2. A working drawing of the SB-20 LED light fixture, 12 volts DC.

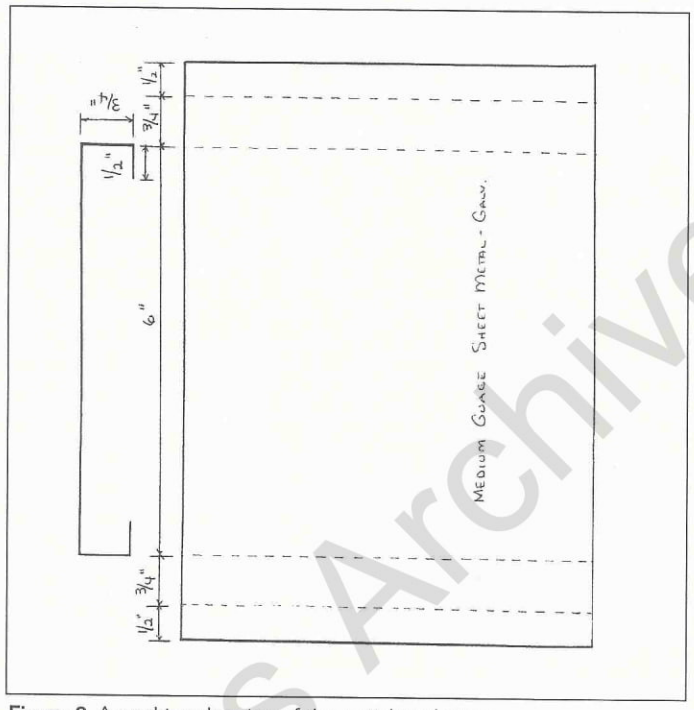

Figure 3. A working drawing of the metal enclosure.

wire nuts rated for #12 wire. Cover with electrical tape (use Uniform Electrical Code procedure).

10. If desired, use a decorative enclosure which can be mounted to the sheet metal enclosure.

Materials List

- One (1): 4.25" x 6" plexiglass base
- One (1): 8.5" x 6" medium gauge, galvanized sheet metal
- Twenty (20): Sunbrite LEDs from Mouser Electronics (1-800-346-6873, Part #697-01TWB9WB12)
- #18 hard copper wire (LED series connection)
- #14 hard copper wire (DC parallel connections)
- #14 stranded copper wire with insulation for leads
- Four (4): bolts 6-32 x 3/4" long with nut and washers
- Two (2): wood screws 1.5" long
- One (1): bridge rectifier from Mouser Electronics, 400 PRV, 1.5 amp, for AC unit only (Part #583-RB154)
- Two (2): wire nuts for #12 wire
- Electrical tape
- Solder and flux

Data Sheet

SB-20 LED Light Fixture, 120 volt AC

Voltage:	120 volts AC
Current:	.06 amps
Power Consumption:	7.2 watts
Illumination:	220 candela

SB-20 LED Light Fixture, 12 volt DC

Voltage:	12 volts DC
Current:	.6 amps
Power Consumption:	7.2 watts
Illumination:	220 candela

Power Consumption Comparison

A 60 watt incandescent bulb uses eight times the power of the SB-20. A 40 watt fluorescent bulb uses five times the power of the SB-20. The SB-20 LED light fixture uses 7.2 watts of power. An incandescent bulb lasts from 750 to 1,000 hours. LEDs last about 100,000 hours.

Those interested may contact the author for more information on his other light fixtures, some of which may be available for purchase soon. See the address below.

About the Author

Mr. Magratten worked for thirty years in residential, commercial, and industrial construction. He also worked for four years with Shell and Chevron. He became interested in energy conservation, renewable energy, and new methods of energy production when he realized that our domestic supply of oil was rapidly being depleted. Mr. Magratten is currently involved in research and development with LED light fixtures, pulsed DC motors, the recreation of the work of Edwin Grey, hydrogen production, and related technologies.

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Remarks to the California Energy Commission:

Public Hearings on Reducing California Petroleum Dependence, July 23, 2003

Brian O'Leary

I thank you for this opportunity to make an appeal to consider robust new energy options that could save the planet. After receiving my Ph.D. in astronomy from UC Berkeley in 1967, I served as a NASA astronaut, after which I became a professor at Cornell and other universities, teaching and researching planetary physics and energy policy, for almost thirty years. Over the past ten years, I have been an author, researcher, futurist, and teacher of new energy concepts. I am president of the New Energy Movement, a nonprofit whose purpose is to cut emissions to zero by 2020 through innovation.

I have returned to live in California because I love the scenery and free thinking here. I think that we Californians share in our hearts a willingness to embrace cutting-edge solutions to the grave problems we now face in the energy crisis before us. More than ever, we must now be forward-thinking and examine all viable options before catastrophe strikes—whether it be war, scarcities, pollution, climate change, or economical/ecological collapse. Our addiction to fossil fuels and nuclear energy lies at the center of our demise and can be overcome by an Apollo program to develop clean energy—even beyond traditional renewables such as solar, wind and hydrogen.

I believe the solutions are there if we can simply overcome our denials and ignorance. In the short run, a blend of conservation and pursuing low-emission options will help enormously. But in the long run, only new energy solutions could solve the challenge. We will need to do much more to understand and embrace the potential solutions.

In 1975, I served as a special consultant on energy for Morris Udall's Subcommittee on Energy and the Environment in the U.S. Congress and as a senior advisor during his presidential campaign. The environmental movement was then growing and we had hopes then that we would have a clean, renewable and independent energy economy by 2000. But the vision became subsumed within the hubris of politics, greed and bad science. *Time* magazine this week declared, ". . .you can thank more than three decades of bungled energy policies. . .Get ready for more bungling."

I am here to urge you to go deeper, to set aside your preconceived ideas about solutions, and to consider some options that the U.S. government has heretofore suppressed. I am here to propose that the state of California study and support R&D of selected new energy options, some of which might have practical application in the near future, and could become the cornerstone of a zero-emission future by 2020, and the end of polluting energy.

Being a physicist, I would not have thought that any of these energy sources would be viable. But after more than a decade of intense study and travel to laboratories all over the world, I have changed my mind. Numerous technologies have been successfully demonstrated to my satisfaction. Included are low-energy nuclear reaction technology (cold fusion), advanced hydrogen technologies, and zero-point energy [vacuum energy]. Unfortunately, some of these concepts do not have public demonstrations yet, but these will happen soon.

You may have heard the loud chorus of skeptics naysaying the efficacy of new energy. At the risk to my own career, I have taken the opposite position: experiments and theories on new energy keep moving ahead as irrefutable results keep coming in and are published in the peer-reviewed scientific literature. We are in the research phase of an R&D cycle awaiting sufficient funding to move forward to commercial application. There are many reasons to believe this process could happen within years with adequate funding, on the order of hundreds of millions, not billions, of dollars.

But the funding must come from somewhere and we have seen that private dollars aren't ready to do this until somebody is ready for commercial takeoff, and we are not there yet. We have a classic chicken-and-the-egg problem, one which the government traditionally fills.

The U.S. government shows no interest in these concepts. So I pose the question to you: could the state of California be willing to have a look? Because if just one of these technologies proves out as a practical energy source, we would be well on our way to a clean and renewable energy economy, perhaps just in time to avoid catastrophe. Would it not be a tragedy that the human experiment fails because we did not have the foresight to embrace the true answers because of our own limitations of vision?

The energy crisis is a physical problem demanding physical solutions that no amount of political hubris, media spin, or legal manipulation could undo. But a concerted effort coming from the public and government could. There may not be as much fast money doing this versus the continuing exploitation of fossil fuels until we run out or become extinct.

We have a choice now: either to slip ever further into the societal suicide from current energy practices or to move into a new energy culture—even if, for the moment, you may perceive this as a longshot (I am here to say it isn't a longshot).

Let us dream for a moment. The Los Alamos National Laboratories, managed by the University of California, has become a center for nuclear energy research and development, a technology which has now proven to be dangerous for a number of good reasons. What if we phased in new energy at Los Alamos, evaluating safety and environmental impact all along the way? Some of its scientists are already working on low-energy nuclear reactions technology. Why not expand this effort? What is the risk, besides to vested interests?

In the end, we will have to make some choices, and I hope, wisely. In spite of its current budget problems, ironically caused by the energy crisis itself, California has a unique opportunity to step forward into the vanguard of a new energy development at very little investment, and as an example to the world. Are we up to the task? ❑❑❑

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In Memoriam: Edward Teller (1908-2003)

by Eugene F. Mallove

Dr. Edward Teller, renowned physicist and advisor to U.S. Presidents on nuclear and defense policies, died at home on September 9 in Stanford, California. He was well known as one of the two key "fathers" of the world's first thermonuclear fusion bomb (the other was mathematician Dr. Stanislaw M. Ulam), which was exploded by the U.S. on November 1, 1952. This "hydrogen (fusion) bomb" vaporized much of the island of Elugelab in the Pacific Ocean with an energy release some 700 times that of the first "atomic (uranium fission) bomb."

Teller had been a controversial figure for much of his career, beginning in the 1940s with his involvement on the Manhattan Project that led to the first fission nuclear bomb, which was tested in July 1945 in New Mexico; a similar bomb was dropped on Hiroshima early the next month. Flying in the face of many of the assumptions of much left-wing hatred for Teller as a pre-eminent "war monger" who also had the audacity to champion high-tech ballistic missile defense, Edward Teller considered it a tragic mistake that two Japanese cities had been decimated to bring the war against Japan to an end. He would have preferred that a fission bomb had been detonated high above Tokyo, flooding that city in blinding, terrifying light. He had written, "If we could have ended the war by showing the power of science without killing a single person, all of us would now be happier, more reasonable, and much more safe."

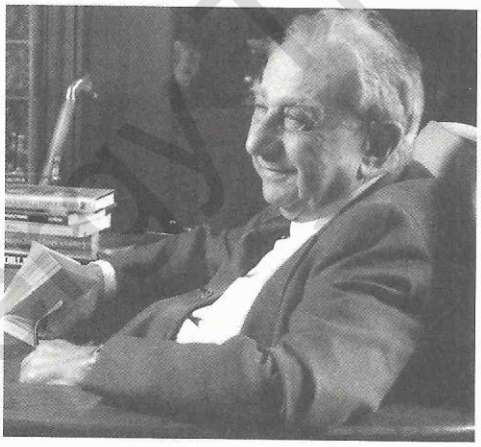

Photo courtesy of Lawrence Livermore National Laboratory

Edward Teller was born January 15, 1908 into the pre-World War milieu of the Hungarian Jewish intellectual community. His parents were attorney Max Teller and Ilona Deutsch Teller. After a precocious childhood, first Teller studied chemistry, but was then drawn into the scientific ferment that was brewing on the frontiers of physics. He would obtain his doctorate under quantum mechanics pioneer Werner Heisenberg at the University of Leipzig in Germany in 1930. He had joined the faculty of Germany's University of Göttingen, but with the rise of Hitler by 1933 Germany was no place for a Jew. He left Germany via a stay first in Copenhagen and later in London, then came to the U.S. He became a physics professor at Georgetown University in 1935 and an American citizen in 1941.

Much of the controversy surrounding the life of Edward Teller began with his involvement with development of thermonuclear weapons. The idea for a fusion bomb that had emerged from Enrico Fermi at Columbia University, even prior to the Japanese attack on Pearl Harbor in 1941, led an initially skeptical Teller, during and after the War, to champion the "super," the hydrogen bomb. In this effort he and like-minded colleagues were opposed, even after the Soviet Union detonated its first fission bomb in 1949. The then Atomic Energy Commission formed a panel to consider initiating a crash program to develop the "super." Led by former Manhattan Project chief scientist J. Robert Oppenheimer, the committee voted against the effort—for both scientific and military-political reasons. The *New York Times,* in its obituary for Edward Teller of September 11, 2003 (by William Broad and Walter Sullivan), describes how this decision got turned around:

> While many—probably most—scientists opposed the H-bomb, Dr. Teller had the support of such distinguished figures as Dr. Ernest O. Lawrence, a Nobel Prize winner, and Dr. Louis W. Alvarez, who eventually became one.
>
> In addition to Mr. Strauss, Senator Brien McMahon, chairman of the Joint Committee on Atomic Energy, and others worked to persuade President Harry Truman to press ahead with the hydrogen bomb. On January 31, 1950, Truman announced that he had directed the Atomic Energy Commission "to continue its work on all forms of atomic weapons, including the so-called hydrogen or super bomb." It was a major victory for Dr. Teller.

The sequel to that landmark event was Teller's public criticism of Dr. J. Robert Oppenheimer, even though he denied that Oppenheimer was "disloyal" to the U.S. This criticism of Oppenheimer gained Teller many permanent enemies.

Not mentioned in any of the mainstream accounts of Teller's life that appear in recent obituaries is his role in the cold fusion saga. A close associate of Dr. Teller's, who prefers anonymity, has told this editor of Teller's great enthusiasm for the new potential discovery of "cold fusion" (potential when he first learned about claims for it in March 1989). In fact, Teller was rather bemused and "upset" that what Fleischmann and Pons had claimed to have discovered had been missed by prestigious U.S. physics labs, such as his own Lawrence Livermore National Laboratory!

As I recounted in *Infinite Energy* (#36, pp. 39-41) Teller also played a key role at a meeting that was held in Washington, D.C. (October 16-18, 1989), two weeks before the U.S. DOE ERAB "Cold Fusion" panel was to render its outrageous rush-to-judgment negative report. In that article, "Encounter with a Cover-Up: Examining a Forbidden Report—*Proceedings of the EPRI-NSF Workshop on Anomalous Effects in Deuterated Metals,*" I quoted Teller's outstanding remarks that are in that record, restated here in part: "I am arguing for a continuation of an effort, primarily for the sake of pure science. And, of course, where there is pure science, sometimes, at an unknown point, applications may also follow. . .I therefore

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applaud the National Science Foundation and the Electric Power Research Institute for maintaining enough interest and enough support so that a real clarification of the apparent contradictions can be pursued. . .My conclusion is that the experimental work on cold fusion should continue until a decision is obtained. . .In any case, the experimental observations, if they are confirmed, must be explained by means that are outside of conventional nuclear physics."

Teller subsequently told the press that he recommended that "in recognition of the the high class work that yielded surprising results, that the efforts be supported to obtain clarification, whether the results are due to sophisticated difficulties in the experiments, or whether a new phenomenon is involved" (from *Fire from Ice*, Mallove, 1991, p. 182). Despite Teller's heroic stance in 1989, the DOE panel did its dirty work, and the rest—as they say—is history.

In addition to Edward Teller's recognized contributions to the theory of Quantum Mechanics, the theory of chemical bonding, and his nuclear physics and weapons work, he was known as an accomplished amateur pianist. His Steinway grand piano accompanied him to Los Alamos during the Manhattan Project. Despite a street car accident in 1928 that left him minus a foot that was replaced by a prosthesis, he was also a superb table-top tennis player. In July 2003 President George W. Bush presented Teller with the presidential Medal of Freedom, the highest civilian award in the U.S. It was accepted for him by his daughter Wendy. Edward Teller is survived also by his son, four grandchildren, and one great-grandchild. Teller's wife Mici shared 66 years of marriage with him; she died in 2000. Among numerous technical publications and books, he leaves an account of his life in his last work, *Memoirs* (Perseus Publishing, 2001). Characteristically, an obtuse and bigoted physicist/humanities Professor at MIT, Prof. Alan Lightman, wrote of this work in the *New York Review of Books*: "Like Dr. Jekyll, Teller is disturbingly aware of his darker side. . .That self awareness, visible in *Memoirs* beneath its fabrications and self-congratulation, is what accounts for Edward Teller's angst and gives him his true tragic proportions." This latter is regurgitated in the *New York Times* obituary. The *New York Times* also served up this from Nobel laureate Dr. Isidor I. Rabi, that Teller ". . .is a danger to all that is important. . .it would have been a better world without Teller."

Would that Dr. Teller had lived long enough so that the small-mindedness of these critics would be shown up with the inevitable widespread recognition of low-energy nuclear reaction phenomenon, for which Teller retained a proper open-mindedness. Sadly, during his declining years he was not active or agile enough to help turn the LENR matter around—and besides, he had enough other battles to fight. Perhaps Dr. Lowell Wood, a close colleague of Teller's who has attended at least three of the most recent international conferences of cold fusion, and who is similarly marginalized by the mud-slinging "politically correct" Teller-bashers, will initiate actions post-ICCF10 that will help lead to this vindication. One can hope.

In his native Hungary, Edward Teller was regarded more charitably than in the U.S. The following is an excerpt from a press release by Lawrence Livermore National Laboratory, covering Edward Teller's receipt of the Hungarian Corvin Medal, an award bestowed by the Hungarian government for exceptional achievement in the arts and sciences; he was presented the medal by delegates of the Hungarian Prime Minister, at his home at Stanford University in August 2001 [see www.eurekalert.org/pub_releases/2001-08/llnl-det081701.php]:

> "Everybody in Hungary knows Edward Teller's name. He made progress not only for Hungary, but for the world," said delegate Szabolcs Kerek-Barczy.
>
> One audience member said after the ceremony that as a child in Hungary, he knew the names of two famous Hungarians, the nineteenth century composer Franz Liszt and Edward Teller.
>
> The presentation honored Teller's work for having "helped end the Cold War without bloodshed." Teller himself, who has received a multitude of honors from around the world, said that this one accomplishment is what he believes to be his greatest achievement. The Hungarian delegates spoke of Teller's accomplishments not only as a scientist, but as a poet and pianist as well. "I am touched by the way he talks about the future of Hungary and often cites Hungarian poetry to support his arguments, " said delegate Attila Verhegyi.

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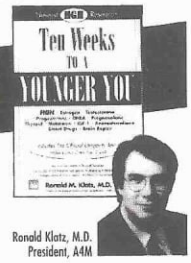

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A Complicated World

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Imagine if the United States stopped consuming oil. Imagine if, over the next three decades, every car and building in the U.S. was powered by electricity from a cheap, non-polluting source. Sound too good to be true? It might be.

On the positive side, debate about the U.S. role in global warming would cease. Air quality in the U.S. would immediately skyrocket, and water quality, at least in some areas, would soon follow.

The economic effects are less clear. If giant corporations like ExxonMobil went the path of the buggy makers, there would be huge economic dislocations. We have a taste of what that would feel like thanks to the crooked energy traders at Enron who stole from their employees and then lied to Congress about it. But the death of Enron only eliminated thousands of jobs; the big oil companies employ millions.

And the economic consequences in America would be just the tip of the iceberg. Forty percent of all the oil extracted from the planet is consumed in the U.S. Even a 25% drop in U.S. demand would absolutely destroy the price, and the effect would ripple across the planet. In the short and not so short term, the economies of producer countries like Venezuela, Mexico, and Russia would be devastated. Perhaps more troubling is the effect it would have in the Middle East, particularly Saudi Arabia.

Twenty five percent of the oil extracted in Saudi Arabia is destined for the U.S. and our SUVs. The Saudis make hundreds of billions from a never-ending parade of super tankers bound for our shores laden with crude. With one of the youngest populations on the planet, Saudi Arabia uses billions of those dollars to provide their children basic social services, food, and education. Unfortunately, part of that education is to teach their children, and other children around the world, to hate the U.S.

While they are teaching their kids to hate us, they are also using tens of those billions to buy advanced U.S. weapons. They are one of our best customers, employing thousands of Americans in the fabrication of fighter jets destined for Saudi Arabia. If America ever stopped buying Saudi oil, the Saudis might have to stop buying U.S. weapons. Millions of Americans busy building fighter jets might lose their jobs. At the same time, Saudi Arabia could go bankrupt, and the millions of its children who had been taught to hate us would no longer be receiving basic social services and education. Hopefully, they won't have learned yet how to fly our jets.

On the flip side, if the price dropped out of the floor, the Saudis would probably be able to sell more oil to China. They already buy missiles from China, so the basic weapons-for-gas two-step is already set up. They wouldn't make near as much money as they do now, but if we could "break our dependence on foreign oil," maybe the Saudi's could teach their kids to hate the Chinese instead of us.

Of course, this scenario is politically impossible. The U.S. is about as likely to significantly reduce oil consumption, thereby bankrupting Islamic terrorists, as it is to decriminalize drugs, thereby bankrupting Central and South American terrorists. At the same time, just like decriminalizing drugs, it might actually be technically possible.

In addition to well known sources of clean, cheap power (wind, solar, geothermal, etc.), technological breakthroughs could create more electricity. Much more.

In 1989, two scientists at the University of Utah reported an experiment where two metal rods were dunked in heavy water and a current was run across them. They claimed that the device produced excess heat, that is, more energy output than energy input. They theorized that this could only be possible as a result of some unexplained nuclear effect, or so-called "cold fusion." Interestingly, the results indicated that unlike other well known nuclear processes, cold fusion seemed to produce far more energy than toxic waste by-product, a result nuclear physicists regarded as an abomination.

Pons and Fleischmann were immediately ridiculed out of the profession in the same manner as many who have made revolutionary scientific discoveries throughout history. The high temperature plasma physics crowd, funded to the tune of billions of taxpayer dollars, were particularly vicious. The physics establishment declared that such a result was not permitted by their models, mostly because it failed to produce a cesspool of nuclear waste, and therefore not possible. Never allowing for the possibility that they or their models might not know everything, the High Priests of Science declared Pons and Fleischmann crackpots, the government and the media bought it, and that little bit of unpleasantness was quickly put behind the scientific establishment. Or so they thought.

The problem was that the plasma crowd never bothered to rigorously check Pons and Fleischmann's results, as the most critical element, the calorimetry that measured the excess heat, was decidedly outside of their area of expertise. Pons and Fleischmann were driven to exile purely on theoretical, and more effectively, rhetorical grounds. This could prove embarrassing if the facts ever come out.

Right now, the physics crowd is safe. They were successful in killing Pons and Fleischmann's idea, along with any threat that the U.S. government might actually fund further research into the matter that might come at their expense. But they couldn't kill the whole notion entirely, because facts are stubborn things.

Over time, other scientists have run more experiments and have confirmed in several instances that with just the right conditions, it is possible to generate excess heat, sometimes a lot of it, and without producing a mountain of nuclear waste. As those results have piled up, the fact that it is possible has become essentially indisputable. Still, despite the profound potential impact of cheap, non-polluting energy, these results are largely unknown. Perhaps this is because they might expose the Emperors of Science as having no clothes.

Where the excess heat comes from nobody really knows. Whether it could be harnessed on an industrial scale may also never be known. What is known is that very little progress is likely in the near future because even discussing it is regarded as career-ending heresy within the only community that really matters—the scientific establishment of the U.S. government that doles out billions of dollars every year to do basic science in the Department of Energy's labs and America's colleges and universities.

Unlimited cheap clean energy could mean clean air and water the world over. It could also end desertification in the third world, pollution in the first world, and global warming throughout the whole world. But, it could also greatly upset the geopolitical applecart, where the status quo quietly sows the seeds of our own destruction. So maybe it is just as well we don't look into such things.

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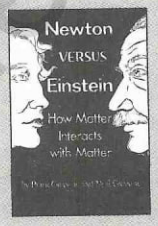

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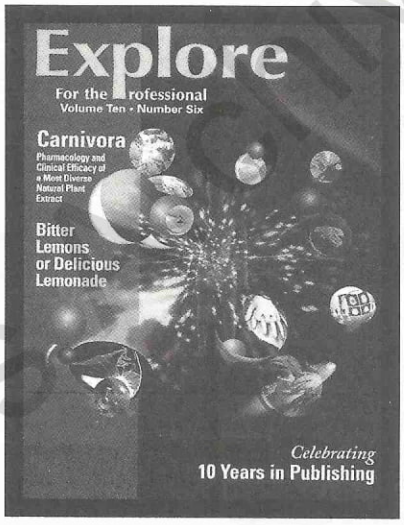

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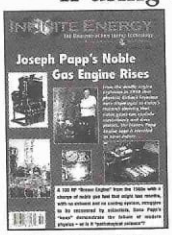

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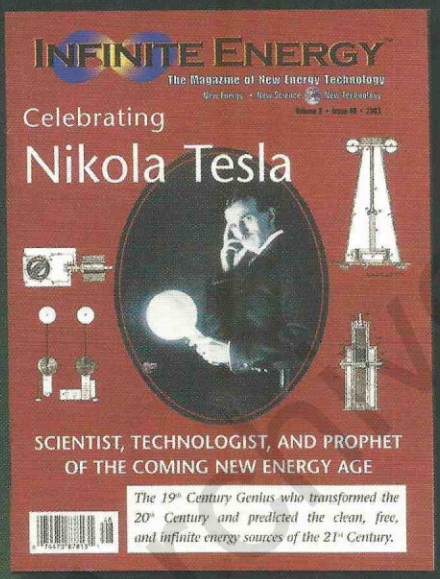

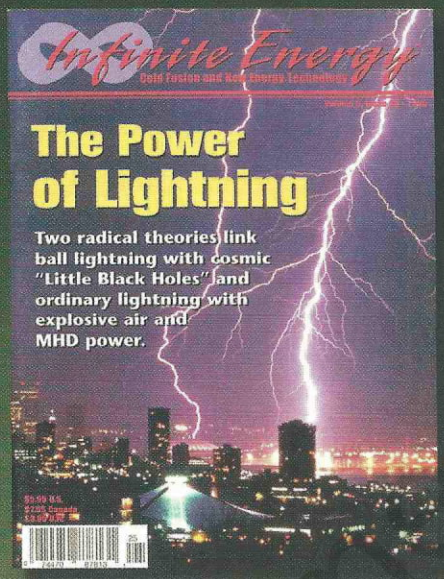

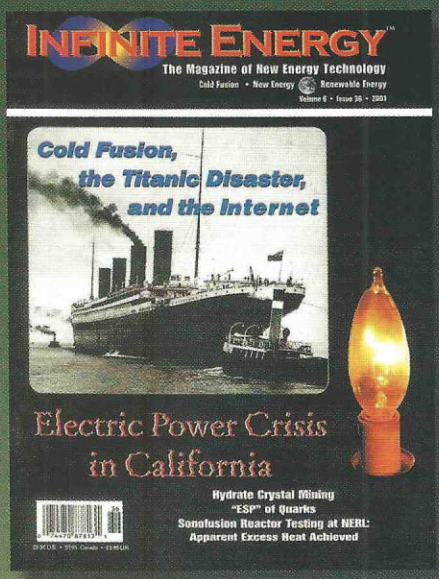

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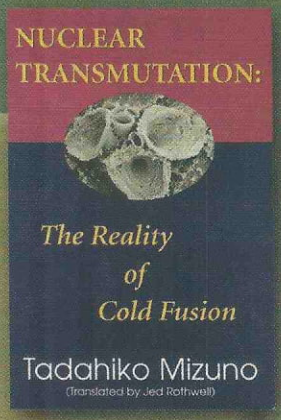

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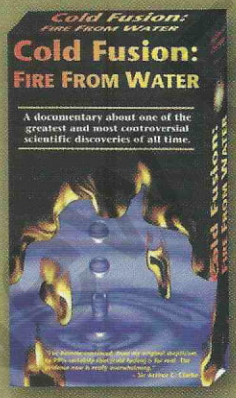

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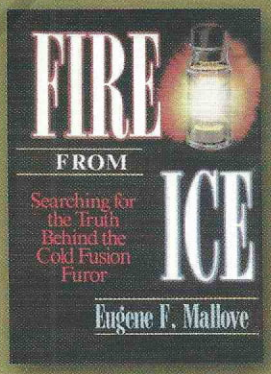

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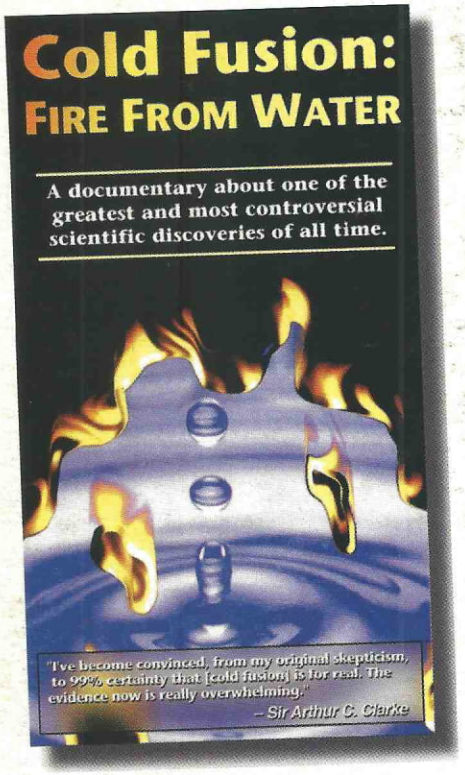

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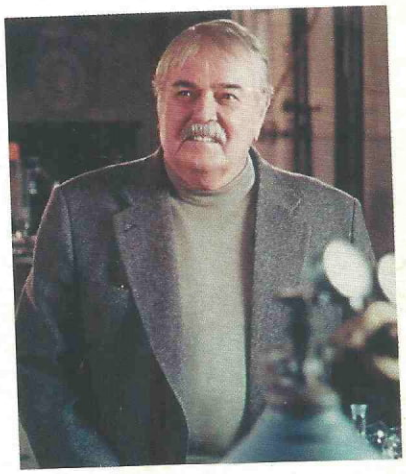

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